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TABLE OF CONTENTS FIRST PAGE

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TABLE OF CONTENTS

ORIGINAL ARTICLES

PAGE

Changes in Tympanic Cavity and Antrum Resulting from Radical Mastoid Operation
Hans Brunner, M.D., Newark, N. J. 655

Lymphomas of the Nasopharynx and Pharynx
Stanton A. Friedberg, M.D., and George M. Hass, M.D., Chicago 677

Photography in Rhinoplasty
Milton L. Jennes, M.D., Waterbury, Conn. 695

Experimental Study of the Efficiency of Two Group Hearing Tests
Kenneth O. Johnson, Ph.D., Washington, D. C., and Hayes A. Newby, Ph.D., San Francisco 702

Intrathoracic Rhabdomyosarcoma
Ward C. Denison, M.D., Ridgewood, N. J. 711

Note on Pseudo-Organic Deafness
Steven B. Getz, Ph.D., Berkeley, Calif. 718

CASE REPORTS

Membranous Cryptococcic Nasopharyngitis (Cryptococcus Neoformans)
Jack C. Norris, M.D., and William B. Armstrong, M.D., Atlanta 720

Impending Asphyxia in an Infant from Nose-Drop "Rebound"
Douglass S. King, M.D., Alliance, Ohio 723

CLINICAL NOTES, NEW INSTRUMENTS AND TECHNIQUES

New Method of Subtotal Laryngectomy
A. Willems, M.D., Luxembourg 726

An Adenoid-Biting Forceps
Fordyce Johnson, M.D., Pasadena, Calif. 733

PROGRESS IN OTOLARYNGOLOGY

Tuberculosis
George E. Wilson, M.D., and William K. Stern, M.D., Saranac Lake, N. Y. 735

SPECIAL REPORTS

Hearing Aids Accepted by the Council on Physical Medicine and Rehabilitation of the American Medical Association, as of Nov. 1, 1954 780

REGULAR DEPARTMENTS

Books 784

Directory of Otolaryngologic Societies 785

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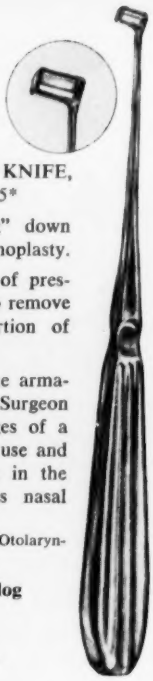

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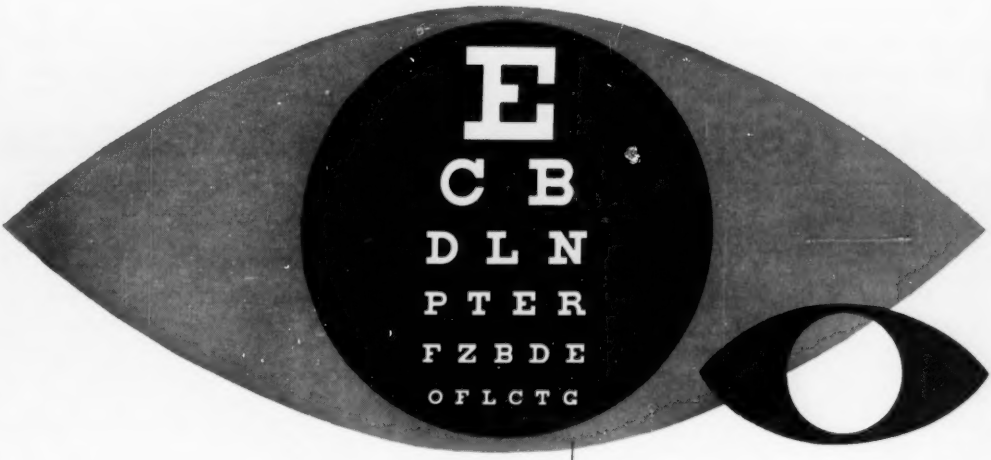

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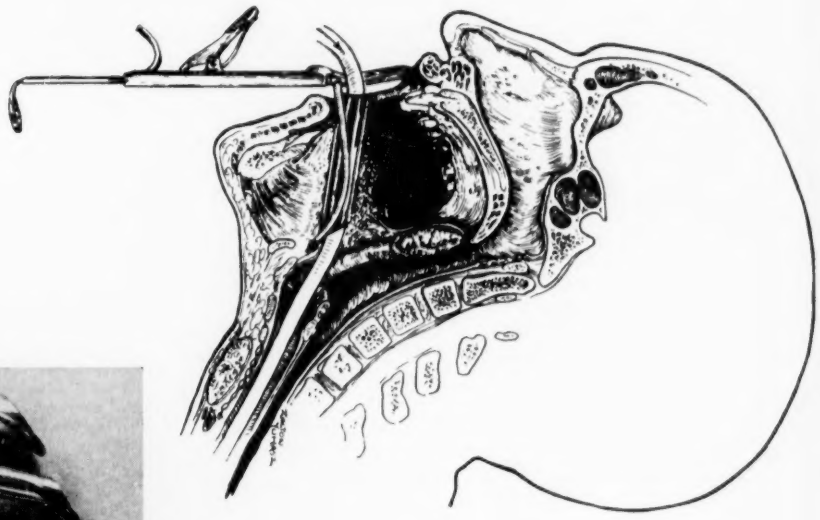

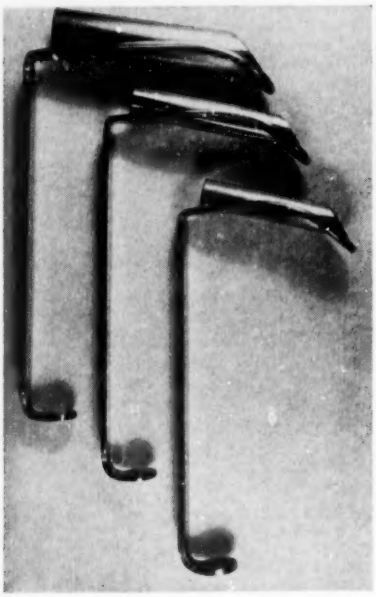

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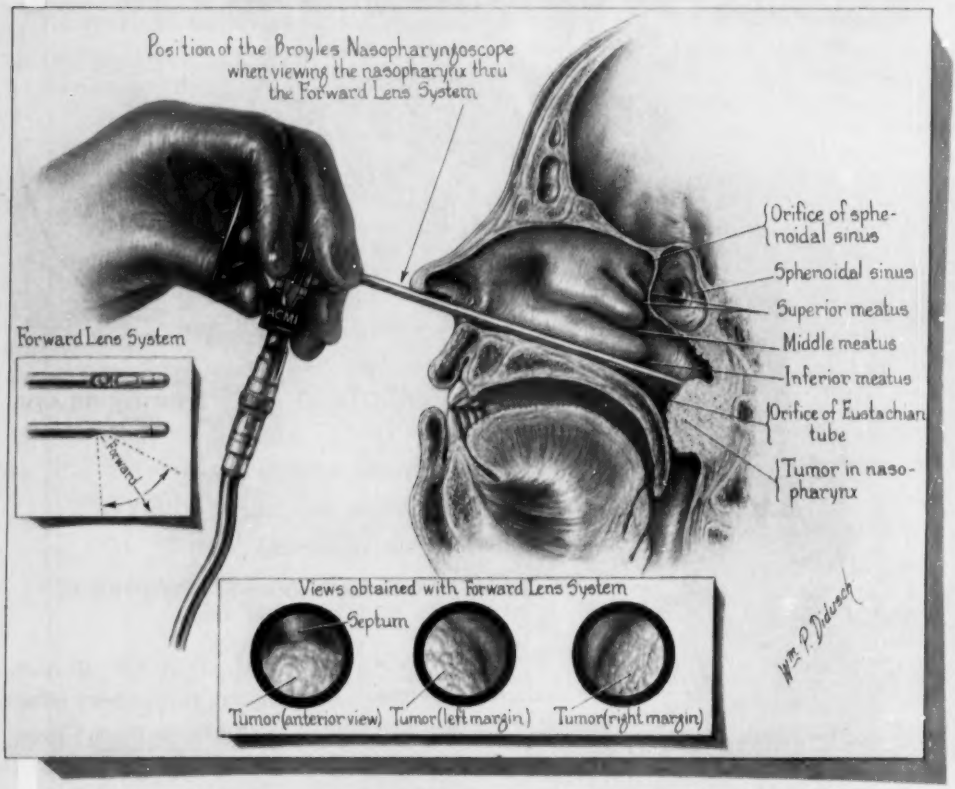

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VOLUME 60 DECEMBER 1954 NUMBER 6

COPYRIGHT, 1954, BY THE AMERICAN MEDICAL ASSOCIATION

CHANGES IN TYMPANIC CAVITY AND ANTRUM RESULTING FROM RADICAL MASTOID OPERATION

HANS BRUNNER, M.D.
NEWARK, N. J.

THE RESULTS of the radical mastoid operation are not quite satisfactory as far as the conservation of hearing and the cessation of the secretion are concerned. For this reason many modifications of the surgical technique have been suggested, a great number of them being disappointing in the long run.

I feel that the recommendation of effective modifications presupposes an exact knowledge of the microscopic cnanges in the tympanic cavity and in the antrum resulting from a radical operation. My microscopic material is not large enough to allow final conclusions in this respect; however, it furnishes certain data which may be important for the technique of the operation.

In a previous study [1] I examined nine temporal bones from eight patients in whom a radical mastoid operation was performed (in one patient a radical operation was performed on both sides). Since that time three additional cases have been examined by my associates and me. The present study, therefore, is based on a surgical experience of more than 30 years and on the examination of 12 temporal bones from 11 patients. In eight instances the operation was performed by my associates and me.

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33 days.....	1 case (cholesteatoma)
20 yr.....	3 cases (preoperative diagnosis not known)
21 yr.....	1 case (preoperative diagnosis not known)

In all these cases the operation was performed from a postauricular incision, employing the classic technique, including a curettage of the hypotympanum and the tube, and a plastic according to Panse. In the cases of cholesteatoma the matrix was removed.

For a better understanding of the postoperative changes in a radical cavity, it is necessary to distinguish between the changes in the attic-antrum, on the one hand, and those in the mesohypotympanum, on the other.

ATTIC-ANTRUM

After a well-performed operation attic and antrum form one single cavity, which opens largely toward the external auditory canal provided that the lateral

attic wall (processus epitympanicus) is entirely removed down to the insertion of the malar process. Immediately after the operation the wall of the cavity is covered by exudate, debris, and blood. There is no mucous membrane and no cholesteatoma matrix. In the presented cases it took approximately three weeks until the formation of granulation tissue, originating from the marrow spaces, was noticed. If the ostitic bone has been radically removed, if the infection is not highly virulent, and if there is no systemic disease, the granulation tissue has only a limited power of growing. It is the task of the after-care to avoid an overgrowth of the granulations, particularly in the aditus ad antrum. Such an overgrowth would result in an obliteration of the aditus and an occlusion of the antrum.

If the inflammation subsides, the granulation tissue changes into connective tissue, covering the walls of the cavity and furnishing the base for the epidermis, which originates from the plastic flaps and extends into the cavity. Finally, the entire attic-antrum is covered by epidermis, and between the epidermis and the underlying bone there is a broad layer of loose connective tissue. Not infrequently the epidermis dips into the connective tissue, forming short, finger-like projections or small pockets filled with cast-off epidermis — "minute recurrent cholesteatomas" (Figs. 4 and 5).

Within the connective tissue a metaplastic ossification may take place, resulting in the formation of a network of bone spicules (Figs. 4 and 5), eventually of an hyperostosis. If the healing advances, the subepithelial connective tissue shrinks and becomes dense unless there is a great amount of newly formed bone, which interferes with the shrinkage of the connective tissue. This condition explains the cases in which the radical cavity appears primarily contracted but becomes spontaneously wider after a period of time, provided that no local treatment is applied which interferes with the shrinkage of the subepithelial connective tissue. Only in the most anterior portion of the attic may the loose connective tissue persist.

The epidermization of the attic-antrum is the usual result of the radical mastoid operation if all ostitic bone has been taken off, if the lateral wall has been removed down to the insertion of the malar process, and if an overgrowth of granulations has been prevented by tampons, antibiotics, and cauterization.

MESOHYPOTYMPANUM

Theoretically, the radical mastoid operation aims at a transformation of mesohypotympanum into a cavity, similar to and continuous with the cavity presented by the antrum-attic. The mesotympanum and hypotympanum are supposed to form a cavity, with even and smooth walls and a large communication with the external canal. However, this aim cannot be achieved to its fullest extent. The walls can never be smooth and even, because, on the one hand, the windows and the hypotympanum form recesses, which are offshoots of the main cavity, and, on the other hand, the facial canal bulges into the cavity. In addition, a hypotympanum of considerable depth does not communicate with the external canal, and the mesotympanum, on the other hand, communicates not only with the external canal but also with the tube.

Microscopic examination reveals other conditions which, likewise, are not favorable for a definite epidermization of the mesohypotympanum. Subsequent to a radical operation the mucosa of this area may be covered by (1) squamous epithelium, (2) cubical or columnar epi-

Fig. 1.—Section through the facial nerve (*F*), the footplate of the stapes in the oval window (*S*), the round window (*T*), and the antrum-attic (*A*), from which the epithelial cover has been removed by curettage. The cholesteatoma matrix (*C*) terminates in *x* and is in the process of being cast off. There is a crevice (*c*), filled with serous exudate, between the cholesteatoma matrix (*C*) and the connective tissue layer of the mucosa (*M*). Cysts (*y*) in the oval window are filled with exudate and cholesteatoma matrix. The patient died seven days after the radical mastoid operation.

thelium, or (3) both columnar and squamous epithelium, or it can be devoid of epithelium. If it is devoid of epithelium, the chance for epidermization is the best. If, prior to the operation, the mucosa has been covered by squamous epithelium, parts of the epidermis are spontaneously cast off after the operation. Microscopically, there is an accumulation of serous fluid between the necrotic epidermis and the subepithelial connective tissue; yet there is no marked inflammation of the subepithelial connective tissue (Figs. 1 and 2). In other words, parts of the cholesteatoma matrix (perhaps the entire matrix in the mesohypotympanum) become necrotic after the operation and are cast off, leaving the mucous membrane devoid of epithelium. In my cases this finding was obtained seven days after the operation, at the earliest, and concerned particularly the area of the windows and the promontorium.

This is an important finding so far as the surgical management of the cholesteatoma matrix is concerned. Years ago

Fig. 2.—Section through the horizontal semicircular canal (*H*), filled with purulent secretion, the facial canal (*F*), and the antrum-attic (*A*). Note that the outer wall of the bony facial canal has been destroyed by the infection and that the cholesteatoma matrix (*C*), which terminates at *x*, covers the exposed facial nerve. It is evident that surgical removal of the matrix in this area must necessarily result in facial paralysis. Beneath the cholesteatoma matrix there is a thick layer of connective tissue, which contains hyperemic blood vessels and a great amount of cysts (*c*). The cysts are covered by columnar epithelium. In *b* a cyst has ruptured through the cholesteatoma matrix. In *a* the cholesteatoma matrix surrounds a piece of granulation tissue. There is an accumulation of serous exudate (*S*) between the cholesteatoma matrix and the subepithelial connective tissue, indicating that the matrix is in the process of being cast off. The antrum-attic (*A*) is covered by a newly formed epidermis (*e*), which is supported by a loose connective tissue. The patient died 14 days after the radical mastoid operation.

there was a controversy between Zaufal [2] and Siebenmann [3] in this respect. Zaufal advocated the complete extirpation of the matrix by means of curettage, electrocautery, and cauterization with trichloroacetic acid. Siebenmann removed only the necrotic masses of the cholesteatoma but did not disturb the matrix. In agreement with the majority of otologists (O. Mayer [4]), I feel that the right path lies in the middle road. The complete removal of the matrix is neither feasible nor necessary as far as the mesohypotympanum is concerned. It is not feasible because in the hypotympanum and in the recesses of the windows pieces of the matrix usually escape surgical removal, regardless of the technique which has been used.* It is not necessary for two reasons: (*a*) The cholesteatoma matrix must be completely removed when there is a progressive ostitis of the underlying bone. In the mesotympanum the ostitis is never as advanced as in the epitympanum or hypotympanum, because in instances in which the bone of the promontorium and the windows is markedly involved there is, as a rule, labyrinthitis, which requires a labyrinth operation, not a radical mastoid operation only. (*b*) The microscopic studies prove that there is a spontaneous expulsion of the entire cholesteatoma matrix, or parts of it, in the mesotympanum subsequent to the radical mastoid operation (Figs. 1 and 2).

So far as the attic-antrum is concerned, the preservation of the matrix does not come into consideration if the matrix is interspersed with granulation tissue. If the matrix is intact and continuous, it is the exception rather than the rule to preserve the matrix, because beneath a grossly intact matrix there may be cysts containing exudate, an ostitis, or evaginations of the main cholesteatoma sac. For this reason, I always have removed the matrix in the attic-antrum entirely; only in some cases of "dry" cholesteatoma of the epitympanum exclusively, which was separated from the mesotympanum by a connective tissue membrane, the matrix has been preserved, provided there is no acute exacerbation and no symptoms of an intracranial complication. In cases of "nature's radical operation" the cholesteatoma matrix remains, of course, likewise in contact with the underlying structures. As far as the hypotympanum is concerned, I attempt to remove the matrix as much as possible, realizing that a complete removal is not possible if the hypotympanum is spacious. In the mesotympanum, I remove the matrix only as far as it is easily done.

For practical purposes, the complete removal of the cubical or columnar epithelium is more important than the complete removal of the squamous epithelium, because the columnar epithelium is less resistant than squamous epithelium to air-borne injuries originating in the external canal. In addition, the columnar epithelium is never spontaneously cast off after the operation. Yet a complete removal of the columnar epithelium is even less feasible than the removal of squamous epithelium, for the same reason as that mentioned concerning the surgical management of squamous epithelium. However, there are still other reasons. The main source of the columnar epithelium is the tube. Since it is, as a rule, not possible to seal off the tube, columnar epithelium ex-

* Manasse [5] has demonstrated microscopically the presence of minute cholesteatomas in the recessus of the oval window subsequent to radical mastoid operations. It is impossible to remove cholesteatomas from this place without injury to the stapes.

tends into the mesotympanum more rapidly than does squamous epithelium, which originates in the external canal. Another source of columnar epithelium is the subepithelial cysts, which occur in practically all cases of chronic otitis, regardless of whether there is cholesteatoma or not (Fig. 2). These cysts may or may not communicate with the tube; in any case, their inner surface is covered by columnar epithelium, which may extend over the tympanic mucosa when the cysts rupture for one or another reason. Cysts which are hidden in the recess of the windows or in a spacious hypotympanum cannot be removed.

In the cases in which my associates or I operated, a thorough curettage had been performed in the tube and in the hypotympanum. Yet in all these cases columnar epithelium was discovered in the recess of the windows, in the area of the promontorium, and in the hypotympanum, regardless of whether there was, in addition, cholesteatoma or not (Fig. 7). It is not likely that the use of low-power magnification at the operation will furnish better results.

FINAL RESULTS

If the inflammation subsides, the epithelium of the mesohypotympanum expands. In this series this occurred at the end of or after the third week. The sources of the newly formed epithelium are (*a*) the epidermis in the antrum-attic, (*b*) the skin of the external canal (Fig. 3), and (*c*) the epithelial spots in the mesohypotympanum which have not been removed by curettage. Attic-antrum, external auditory canal, and the remnants of the cholesteatoma matrix furnish squamous epithelium; the tube and the remnants of the columnar epithelium furnish cubical or columnar epithelium. For this reason the following results may be obtained in the mesohypotympanum:

1. The cavity is covered by squamous epithelium, which is continuous with the

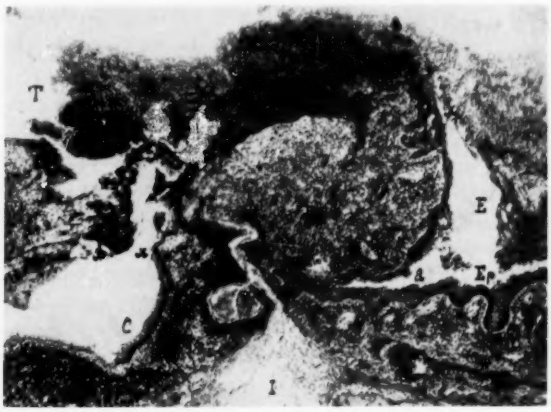


Fig. 3.—Section through the external canal (*E*), the tympanic cavity (*T*), and the inferior insertion of the drum membrane (*I*). The remnants of the connective tissue layer of the drum membrane form a corkscrew-like structure, which is embedded in a granulation polyp. *C* indicates the columnar epithelium of the tympanic cavity, which extends up to *x*. *Ep* indicates the squamous epithelium of the external canal, which encroaches upon the polyp and extends up to x_1. Between *x* and x_1 the polyp is devoid of epithelium. The epidermis not only covers the polyp but has a definite tendency to extend into the polyp, particularly in *a*. The patient died four days after the radical mastoid operation.

squamous epithelium in the attic-antrum. In other words, the entire radical cavity is covered by epidermis.

2. Mesohypotympanum is covered by columnar or cubical epithelium, which may extend into the antrum, or even into the external canal.

3. Mesohypotympanum is covered by both squamous and columnar epithelium.

1. Epidermization of the Cavity

I had the opportunity to examine microscopically one temporal bone on which a radical mastoid operation had been performed approximately 20 years prior to the patient's death.

Case 1.—The patient was a 39-year-old woman. When she was 19 years old, a radical mastoid operation was performed on the right side. Details of the operation are not available. She was under treatment for one year, until the cavity became dry. Ever since then the cavity had remained dry.

Microscopically, the mucosa of the tube was covered by columnar epithelium. The walls of the tympanic cavity and antrum were covered by epidermis, which showed a moderate degree of keratinization. The subepithelial connective tissue consisted of a thick layer of loose connective tissue in the hypotympanum and of a thin layer of firm connective tissue in the tegmen tympani and on the horizontal semicircular canal. The anterior portion of the attic was obliterated by firm connective tissue, fat tissue, and newly formed bone and was covered with epidermis. The epidermis bridged the recessus of both windows, creating "dead spaces" in both windows, which were filled with serous cellular exudate.

In this case the entire cavity was covered by squamous epithelium, which showed a slight degree of keratinization and desquamation. There were no finger-like projections of the epidermis into the connective tissue. In the attic-antrum the epidermis was well bound down to the bone, and there was only a thin layer of firm connective tissue between bone and epithelium except in the most anterior portion of the attic, where the subepithelial connective tissue formed a thick layer. In the mesohypotympanum the epidermis did not dip into the recessus of the windows, but covered them as a lid covers a pot. This is a common finding: Epithelium usually does not extend into narrow cavities as, e. g., the recessus of the windows or the hypotympanum; rather, it has a tendency to bridge these cavities. Either the cavity is empty, forming a "dead space," or it is obliterated by connective tissue, containing cysts.

Case 1 offers what is called the optimum result of a radical mastoid operation. By this is meant the surgical cure, and not the functional result. In fact, the hearing in these cases is usually markedly impaired because the epidermis bridges the recessus of the windows, causing an impairment of the motility of the windows. But as far as the surgical cure is concerned, the results are as a rule satisfactory, because there is no secretion from the ear and the danger to life is practically eliminated. According to Mayer,[4] this result has been obtained in approximately 70% of the cases operated on by the postauricular approach. The result was also satisfactory in Case 1 because the ear was dry for 19 years.

However, the favorable result is not always permanent in these cases. There are frequently episodes which change the findings of the cavity. These episodes are caused (1) by reinfection and (2) by formation of recurrent cholesteatoma. Reinfections of an epidermized cavity are by no means rare. Neumann[6] has examined microscopically two cases of this type.

One patient died 6 years and the other 21 years after the radical mastoid operation. In both instances the cavities were filled with cerumen, debris, and a small amount of pus. In one case there was an abscess in the retro-

auricular scar, six months prior to death, which was cured by an incision. In both instances a curettage of the tube had been performed at the radical mastoid operation.

Microscopically, the cavities were covered by an epidermis, which showed several defects. The defects were replaced by inflamed connective tissue, forming granulations. Beneath the intact epidermis the connective tissue formed a thick layer in some places and a thin layer on other places. The connective tissue was only slightly inflamed. Finger-like projections of the epidermis extended into the connective tissue. In the area of the horizontal semicircular canal there were osteoclasts beneath an intact epidermis cover; in other places newly formed bone was noticed beneath the epidermis. In the recessus of the windows were several cysts filled with serocellular exudate and covered by an intact epidermis.

Reinfections of an epidermized cavity occur, for several reasons: (*a*) Bacteria migrate through the epidermis and cause an eczema humidum or eczema squamosum of the epidermis cover. (*b*) In areas in which beneath the epithelium there is only a thin layer of connective tissue, poor in blood vessels, the epidermis may become necrotic, inviting infection. (*c*) Cysts which are hidden beneath an epidermis cover and communicate with the tube may become infected, and the infection may come through the epidermis. This occurs particularly in the recessus of the windows and in the hypotympanum and may be noticed at any time after the operation.

For many years the tube and the peritubar marrow spaces have been considered responsible for the reinfection of radical mastoidectomy cavities. The importance of the tube in this respect should not be questioned, but it should not be exaggerated either. In Case 1 the radical cavity was dry for about 19 years; yet the tube was patent and covered by columnar epithelium. In another of my cases there was a severe infection of the radical cavity; yet there was no acute inflammation of the mucosa of the tube, and the peritubar marrow spaces were only slightly inflamed. In a third case there was, likewise, a severe infection of both the radical cavity and the tube, but the peritubar spaces were only slightly inflamed. These, and similar, findings obtained by other investigators (Mayer [4]) point to the conclusion that the tube and the peritubar marrow spaces are by no means the only sources of the reinfection of a radical cavity. For this reason the great effort which was expended to seal off the tube does not seem warranted. I have routinely performed a curettage of the tube in the past, using the curette of Alexander. The results have been disappointing. At present, I remove only polypi or cholesteatoma in the area of the tube but refrain from other manipulations.

Reinfections of radical cavities can be avoided, to a great extent, if the cavity is kept clean and is periodically checked. The reinfections are not dangerous and respond well to local treatment, viz., local application of antibiotics.

Recurrent cholesteatomas of a well-epidermized cavity are not frequent; they are usually small and clinically not important. They are discussed later in the article.

2. Radical Cavities Covered by Columnar Epithelium

I had the opportunity to obtain the microscopic findings in two temporal bones in which radical mastoid operations were performed approximately 21 years prior to the patient's death.

Case 2.—The patient was a woman aged 25 years. When she was 4 years old, a radical mastoid operation was performed on both sides. Twenty-one years later there was on both sides a radical mastoid cavity, which contained much granulation tissue and purulent secretion. Microscopically, the mucous

membrane of the tube on the right side was inflamed, and there was purulent secretion in the tube. The epithelium of the tube was columnar; on some places it was absent. In the anterior portion of the tympanic cavity the mucosa was replaced by granulation tissue, which was covered with columnar epithelium. The epidermis of the external auditory canal extended into the tympanic cavity, crossing and compressing the remnants of the drum membrane. However, the epidermis was arrested at the annulus tympanicus, where it met with the columnar epithelium of the radical cavity. On the superior wall of the external canal, the columnar epithelium extended beyond the annulus tympanicus into the external auditory canal. The anterior portion of the attic was obliterated by firm connective tissue; the posterior portion was filled with granulation tissue containing many cysts. The antrum was narrow and almost obliterated by granulation tissue. The recessus of the windows were obliterated by connective tissue containing several cysts. There was no epidermis in the cavity—only columnar epithelium.

On the left side the findings were essentially the same. However, on that side the antrum was covered by epidermis. There were no finger-like projections of the epidermis into the subepithelial tissue.

In this case the operation on the bone was apparently well performed: The "bridge" and the lateral wall of the attic were removed, and there was only moderate obliteration of the antrum-attic. Yet the walls of the cavity on the right side were either devoid of epithelium or covered by columnar epithelium, which extended along the superior wall into the external canal; on the left side the antrum was epidermized, but the rest of the cavity was covered by columnar epithelium. The mucosa was inflamed on both sides, forming granulation tissue, and there was purulent secretion in the cavities and tubes on both sides. Like the squamous epithelium, the columnar epithelium did not extend into the attic or the recessus of the windows but bridged the cavities. Although the operation had been performed 21 years ago and the cavity had probably been discharging all the time, no cholesteatoma had formed in the cavity. A similar case was reported by Mayer.[4]

On a 60-year-old man a radical mastoid operation was performed 10 years prior to his death. A curettage of the tube and hypotympanum had probably been made. The operation on the bone was well performed. Nevertheless, there was always secretion in the cavity. Microscopic examination revealed a thick inflamed mucosa, covered by columnar epithelium, and luxation of the stapes, probably caused by the curettage of the middle ear. Yet there was no labyrinthitis.

It is not always possible to state the reason for the postoperative expansion of the columnar epithelium in these cases. In Case 2 a bilateral radical mastoid operation was performed when the patient was 4 years old. This is an unusual procedure in this age group. I do not know the indication for the operation in this particular case, but it is a common experience that radical mastoid operations performed in young children do not have a good chance to result in a dry cavity. In the case of Mayer, no reason was discovered for the expansion of the columnar epithelium.

In my opinion, the expansion of the columnar epithelium is the main reason for the reinfection and the prolonged secretion of the radical cavity, since this type of epithelium does not tolerate the exposure to the contaminated air, since it is not supported by a highly vascular tissue and is not endowed with cilia, as is the respiratory epithelium of the nasal passages. However, in these instances the underlying bone usually does not become involved, regardless of the duration of the secretion. Likewise, recurrent cholesteatoma does not develop in cavities of this type.

3. Radical Cavities Covered by Both Squamous and Columnar Epithelium

A radical cavity covered by both squamous and columnar epithelium is the poorest result of the radical mastoid operation. The amount of secretion increases considerably and may become fetid. The reason is evident. The squamous epithelium, on the one hand, requires a dry environment, which is deleterious for the columnar epithelium; the columnar epithelium, on the other hand, requires a humid environment, which encourages desquamation of the squamous epithelium. The exfoliated epidermis lamellae irritate, in turn, the columnar epithelium, creating a vicious circle, which results in a permanent status of irritation in all places where the two types of epithelium clash. Because of the status of irritation, infection of the respective areas is encouraged. The infection originates in the external canal or in the tube and results in the formation of purulent discharge, granulation polypi, and, frequently, recurrent cholesteatomas.

RECURRENT CHOLESTEATOMA

Unlike the recurrent secretion, the finding of a recurrent cholesteatoma in a radical cavity is not frequent, provided that a distinction is made between simple epidermization of the cavity, on the one hand, and cholesteatoma, on the other.† This distinction must be based on the finding of the underlying bone, and not on the exfoliation of necrotic epidermis only. It is not extraordinary to notice a moderate amount of exfoliated epidermis lamellae in an epidermized cavity. In instances in which the expulsion of the necrotic material is impeded, e. g., by a neomembrane in the external canal, the amount of necrotic material in the cavity may be considerable, and there may be, in addition, a slight amount of secretion. Because of the pressure of the accumulated necrotic material, small spots of the epidermis cover may become inflamed and necrotic. Yet all these findings are compatible with a simple epidermization of the cavity, particularly in instances of eczema squamosum of the epidermis cover. It is in agreement with this concept that the cavity becomes rapidly dry in these instances if the necrotic material is removed.

For the diagnosis of a genuine cholesteatoma of a radical cavity, the involvement of the underlying bone must be proved. Microscopically, the following findings are obtained: (1) necrosis of considerable parts of the epidermis, on the one hand, and a large amount of finger-like projections of the intact epidermis into the subepithelial connective tissue, on the other; (2) marked inflammation of the subepithelial connective tissue; (3) destructive ostitis due to the activity of granulation tissue and osteoclasts (Fig. 6). The clinical symptoms which indicate a genuine cholesteatoma of a radical cavity are: (1) a great amount of cast-off lamellae, which recur rapidly after removal even though there is no obstruction of the external canal; (2) the finding of a cholesteatoma sac in the cavity, and (3) a purulent and granulating ostitis of the walls of the cavity, which frequently causes labyrinthine symptoms and/or pain in the area of the auriculotemporal nerve.

From the pathologic point of view, the term "recurrent cholesteatoma" is ambiguous. It may indicate that a cholesteatoma is newly formed in the radical

† This distinction is, of course, superfluous in instances of chronic otitis in which no operation has been performed. In these instances the finding of necrotic epidermis and cholesterol crystals in the aural discharge indicates cholesteatoma.

Fig. 4.—Section through the attic-antrum (*A*), the posterior portion of the tympanic cavity (*T*), the horizontal semicircular canal (*H*), and the facial nerve (*F*). The entire cavity is covered by a newly formed epidermis, which has originated from the plastic flaps (*E*) and from the floor of the external canal (E_1). In *a* there are finger-like projections of the epidermis into the subepithelial connective tissue; in *c* there is a minute cholesteatoma. The newly formed epidermis is supported by a loose connective tissue, which in *b* contains newly formed bone. The patient died 33 days after the radical mastoid operation.

cavity or that a cholesteatoma which has been in the middle ear prior to the operation has expanded subsequent to surgery.

The new formation of a cholesteatoma in a radical cavity is not frequent except for the minute cholesteatomas, which are not uncommon in epidermized cavities but do not expand and do not produce clinical symptoms. Usually they empty spontaneously into the main cavity. Disregarding the minute cholesteatomas, a cholesteatoma of a radical cavity may be newly formed in a case in which a cholesteatoma existed prior to the operation (Type I) or in a case in which no cholesteatoma existed prior to the operation (Type II). Cases of Type II are very rare, because cases of chronic otitis without cholesteatoma are less frequently subject to a radical mastoid operation than are cases with cholesteatoma. In all these cases (Types I and II), the term "recurrent cholesteatoma" is a misnomer, because an original, not a recurrent, cholesteatoma forms in the radical cavity. Case 5 presented in this paper belongs to Type II.

Type I, in which a cholesteatoma is newly formed in a radical cavity subsequent to the operation on an original cholesteatoma, is exemplified by Case 3.

Case 3.—The patient was a man aged 25 years, who died of a cerebellar abscess, 33 days after the radical operation. At the operation the middle ear was found to be filled with granulations and cholesteatoma. The tube and hypotympanum were curetted.

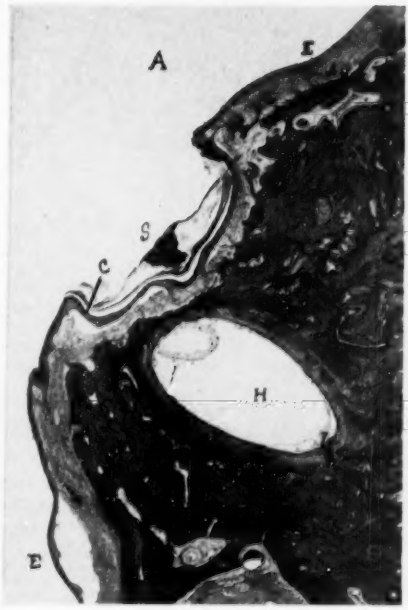
Microscopic examination revealed that the mucosa of the tube was devoid of epithelium.

Fig. 5.—Section through the same area as that shown in Figure 4. The designations are the same as those in Figure 4. *S* indicates the stapedial muscle; *C*, the newly formed small cholesteatoma.

Fig. 6.—Upper left, section through the attic-antrum (*A*) and the horizontal semicircular canal (*H*). *E*, newly formed epidermis, which forms in *C* a cholesteatoma. In the area of the cholesteatoma the subepithelial connective tissue is inflamed and destroys the bone of the semicircular canal. In *S* there is a small sequestrum, which is in the process of being expelled through the matrix of the cholesteatoma. *N*, newly formed bone in the subepithelial connective tissue. The patient died 33 days after the radical mastoid operation.

Upper right, same area as that shown in the preceding illustration. The sequestrum (*S*) is expelled, but the cholesteatoma matrix still shows a deep depression; *x* indicates the borderline between inflamed and bland subepithelial connective tissue. Note the minute cholesteatoma in the inferior part of the epidermis cover.

Lower right, same area as that shown in upper portions. The opening of the cholesteatoma matrix, through which the sequestrum (*S*) has been expelled, is closed; *c*, minute cholesteatoma.



The hypotympanum was filled with connective tissue, which contained many cysts. On the inner surface of the cysts there was usually columnar epithelium. In the anterior part of the hypotympanum the connective tissue either was covered by spot-like areas of columnar epithelium or it was devoid of epithelium. In the posterior part of the hypotympanum the connective tissue was covered by squamous epithelium, which originated in the floor of the external canal and extended into the middle ear, up to the area of the round window. The recessus of the round window was oblit-

erated by cystic connective tissue, covered by spot-like areas of columnar epithelium. The mucosa at the promontorium and the processus cochleariformis was devoid of epithelium.

Antrum and attic were covered by squamous epithelium, which originated from the plastic flaps and extended over the horizontal semicircular canal and the facial canal, down to the inferior margin of the oval window. In the posterior part of the tympanic cavity, the epidermis originating from the plastic flaps fused with the epidermis originating from the floor of the external canal (Fig. 4). The epidermis had a smooth and even surface; it was moderately desquamating and was supported by a connective tissue layer of varying thickness, poor in nuclei and blood vessels. There were only a few short, finger-like projections of the epidermis into the connective tissue, but

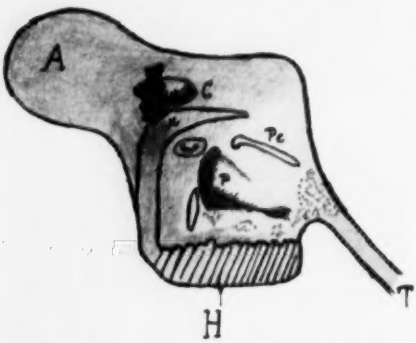


Fig. 7.—*A*, antrum; *c*, horizontal semicircular canal; *Pc*, processus cochleariformis; *P*, promontorium; *T*, tube; *H*, hypotympanum. The shaded area indicates the epidermized area; the stippled area, columnar epithelium; the clear area, absence of epithelium. In *x* there is a defect of the epidermis cover, replaced by granulation tissue and a newly formed cholesteatoma.

there was formation of a considerable amount of new bone in the connective tissue (Figs. 4, 5, and 6). The new bone formed a network or a disk-like hyperostosis, which was grown together with the underlying bone. In the area of the oval window, the connective tissue caused an obliteration of the recessus; in that area there were several cysts in the connective tissue.

In the posterior portion of the horizontal semicircular canal, close to the knee of the facial nerve, the epidermis formed a shallow groove (Fig. 6), which, toward the ampullar end of the horizontal semicircular canal, terminated in an "epithelial pearl" beneath the epidermis. The groove had sharp margins and was filled with cast-off epidermis lamellae. At the margins of the groove the finger-like projections of the epidermis extended deeper into the subepithelial tissue. In other words, the simple epidermis cover of the attic-antrum suddenly changed into a cholesteatoma matrix.

In accordance with the presented concept of a cholesteatoma matrix, there was also an ostitis in that area. The subepithelial connective tissue changed into an edematous granulation tissue, rich in cells, which had distinct boundaries toward the connective tissue of the rest of the attic-antrum. In the area of the granulation tissue there was only a slight degree of osteogenesis, but there was a marked osteoclasis of the underlying osseous semicircular canal. Both the newly formed and the original bone of the semicircular canal had been resorbed by osteoclasts, which at the time of death were absent, leaving many empty Howship's lacunae. The destruction of the bone extended close to the endosteum of the horizontal semicircular canal, but there was no labyrinthine fistula and no pathology within the semicircular canal. In other words, there was a granulating ostitis of the horizontal semicircular canal; the absence of osteoclasts and the finding of a mild osteogenesis indicated that the ostitis was subsiding.

As a result of the ostitis, a sequestrum had formed, which was in the process of being expelled into the antrum (Fig. 6). The sequestrum had perforated through the cholesteatoma matrix and become caught in the perforation. In this area the epidermis made a sharp angle and dipped into the subepithelial tissue, close to the walls of the sequestrum. Findings of this type give rise to the false impression that the epidermis has resorbed the bone. Actually, the bone had been resorbed by the granulation tissue, and the epidermis dipped secondarily down into the defect. It is a fair conclusion that the perforation of the matrix would have closed after the expulsion of the sequestrum.

In this case, in which the patient died 33 days after the radical mastoid operation, the epidermization of the cavity was in progress, the attic-antrum and a part of the mesohypotympanum having been epidermized (Fig. 7). Since a great

part of the tympanic mucosa was devoid of epithelium and there were only small spots of columnar epithelium, it is likely that the entire cavity would have been epidermized if the patient had survived the cerebellar abscess.

The recurrent cholesteatoma formed after the operation. There is no reason to assume that at the operation remnants of the original cholesteatoma were left in situ, because there is no problem in removing all traces of the matrix from the convexity of the horizontal semicircular canal. In addition, microscopic examination proved that the cholesteatoma matrix was nothing else than a part of the epithelial cover of the attic-antrum, which certainly had been newly formed after the operation. This finding indicates that under certain circumstances the epidermis cover may change into a cholesteatoma matrix. Microscopically, the epidermis cover differs from a cholesteatoma matrix in these points: 1. The cholesteatoma matrix forms a groove or a small pocket, whereas the epidermis cover adheres closely to the uneven contours of the underlying bone. 2. The desquamation of the cholesteatoma matrix is more intense than the desquamation of a simple epidermis cover. 3. The finger-like projections of the cholesteatoma matrix are longer and more numerous than the projections of a simple epidermis cover. 4. There is an active ostitis beneath the cholesteatoma matrix.

The question arises concerning the circumstances which cause the epidermis cover to change into a cholesteatoma matrix. In this respect the granulating ostitis beneath the matrix is important. In Case 3 the ostitis developed after the operation, for there was no ostitis at the time of operation. However, I am not prepared to state whether the cholesteatoma is the result of the ostitis or, vice versa, whether the ostitis is the result of the cholesteatoma. It seems more likely that there was primarily a superficial ostitis of the semicircular canal which developed after the operation and caused the epidermis cover to change into a cholesteatoma matrix. However, regardless of whether this concept is correct or not, the findings prove that an intact epidermis in a radical cavity may cover areas of ostitis which eventually are associated with the formation of a sequestrum.‡ Usually, neither the ostitis nor the cholesteatoma advances to a great extent in these instances, the ostitis subsides spontaneously, and the cholesteatoma drains into the main cavity. There are, of course, exceptions to this rule.

Newly formed cholesteatomas in a radical cavity are rare, and I do not know whether another microscopically examined case similar to Case 3 is available. The majority of cholesteatomas in radical cavities are not newly formed but are due to an incomplete operation on the bone and/or incomplete removal of the cholesteatoma. The failure of the operation on the bone consists in an incomplete removal of ostitic bone and in the incomplete exposure of the terminal edges of the epitympanum and hypotympanum. The failure to remove all of the ostitic bone is usually, though not always, avoidable. The failure to expose the terminal edges of the epitympanum is likewise avoidable when the entire lateral attic wall is taken off down to the insertion of the malar process. The failure to expose the terminal edges of the hypotympanum is usually not avoidable, because the lateral wall of the hypotympanum, viz., the floor of the bony external canal, cannot be removed as completely as the lateral wall of the attic.

‡ Neumann[6] noticed in one case osteoclasts beneath an intact epidermis cover of a radical cavity.

Complete removal of a cholesteatoma from the mastoid, petrous bone, and the tympanic cavity is not possible, as mentioned before. But in my experience the operation on the bone is of primary importance and the management of the cholesteatoma matrix is secondary as far as the formation of a recurrent cholesteatoma is concerned. If all the ostitic bone, and if the cholesteatoma, as far as can be reached, are removed, and if the cavity, with all its pockets, has a large communication with the external canal, a recurrent cholesteatoma will not form. Remnants of the matrix, which even with the most careful technique have not been removed at the operation, may eventually be cast off spontaneously after the operation. The usual findings in a recurrent cholesteatoma are illustrated by the following case:

CASE 4.—W. M., aged 30, had a radical mastoid operation on the right side on July 20, 1945, which was performed by another otologist. The available report of this operation is not clear. It says that the mastoid process was sclerotic and the antrum was narrow. The tegmen was almost completely removed. A curettage of the middle ear was performed, "but no damage was done to the ossicles." In the secretion Pseudomonas aeruginosa and nonhemolytic Staphylococcus aureus were found. Subsequent to the operation the hearing became impaired, and the patient had attacks of dizziness. The dizzy spells decreased, but the hearing did not improve. His chief complaint, however, was severe pain around the right ear.

On Dec. 10, 1948, a retroauricular scar was noticed on the right side, which was markedly retracted in the area of the antrum. There was a fetid secretion from the right ear and a large perforation, including Shrapnell's membrane and both anterior quadrants of the drum membrane, filled with cholesteatoma. The patient was almost stone-deaf on the right side. There was no spontaneous nystagmus or symptom of fistula, and the caloric test was normal.

Because of his intense pain, on Jan. 11, 1949, an incision was made in the retroauricular scar. A band of connective tissue, inserting on the skin, extended into the mastoid cavity, which was the size of a cherry stone. The cavity was filled with granulations and cholesteatoma. It extended into the antrum, on one side, and into the petrosal angle, on the other side. The bony shell of the sinus bulged far into the cavity. The sinus had been exposed in a small area; its wall was normal. The dura had been exposed on the base, as well as on the convexity of the temporal lobe, and was firmly grown together with the skin. The posterior wall of the external canal was high, and the "bridge" had not been removed. Only a small portion of the lateral wall of the antrum had been removed, and the defect was filled with newly formed bone. A skin plastic had not been performed.

The radical mastoid operation was completed. In the attic and in the hypotympanum a large amount of cholesteatoma was removed. The dura of the middle fossa was bulging toward the antrum and the attic. Ossicles were absent; the tube was patent. The bone of the facial canal was necrotic and fractured, but the nerve was not exposed. A plastic was made.

A few hours after the operation there was complete facial paralysis on the right side but no labyrinthine symptoms. The facial paralysis improved gradually, and four years after the operation it was noticeable only when he smiled. Antrum and mastoid were well epidermized. The inferior part of the drum membrane was present; eminentia pyramidalis and chorda tympani were visible. The chorda tympani was functioning. There was a large cavity above the oval window, which extended deep into the petrous pyramid, toward the frontal semicircular canal. The cavity was filled with granulations and cholesteatoma. The granulations were particularly abundant in the area of the facial canal. The patient was stone-deaf on the right side, but the labyrinth was still excitable. There was only periodical headache.

Although exact data are not available, it is likely that the lesion was a cholesteatoma at the beginning. An operation was performed, but it was not a radical one, because the posterior wall of the external canal had not been lowered and the "bridge" had not been taken off. The result of the operation was a further expansion of the cholesteatoma into the facial canal and into the petrous bone.

At the reoperation the radical mastoid operation was completed, but the result was poor. There was facial paralysis immediately after the operation, although this area was handled with the utmost care. The nerve was not grossly damaged, because the paralysis subsided spontaneously, the chorda tympani remained functioning, and there were no labyrinthine symptoms. It is likely that the findings of the facial canal were similar to those presented in Figure 2, which shows the outer wall of the facial canal to be destroyed by the cholesteatoma. It is evident that in cases of this type even a careful manipulation may result in a facial paralysis. However, the facial paralysis was not the only failure. The cholesteatoma matrix was not completely removed from the petrous bone at the revision operation; this resulted again in a recurrent cholesteatoma and progressive ostitis of the petrous bone.

At the time of writing the facial paralysis and the headache have subsided, and there is no purulent labyrinthitis, since the stone deafness is caused by a "cholesteatoma deafness," and not by a purulent infection of the inner ear. However, there is no doubt that in the future another operation must be performed, because sulfonamides and antibiotics cannot arrest an ostitis due to cholesteatoma.

Next to the incomplete operation on the bone and the incomplete removal of the cholesteatoma matrix, the implantation of Thiersch flaps into the radical cavity is supposed to be the cause of the formation of recurrent cholesteatoma.

The idea of placing Thiersch flaps into the cavity goes back to Jansen, Ballance, Politzer,[7] and others. Ever since, the implantation of Thiersch flaps has been performed by many otologists. I have used this method in a great number of cases in the past. After a long period of trial I abandoned the method because it did not shorten the after-care. However, to my knowledge, the formation of cholesteatomas was not noticed in these instances. Recently Peterson[8] reported the formation of cholesteatoma subsequent to modified radical mastoid operations in 11 of 41 cases. In 4 of the 11 cases he gives details of the history. According to the criteria for the diagnosis of a recurrent cholesteatoma, stated in this paper, I feel that in three of the four cases of Peterson the findings are compatible with the diagnosis of a simple epidemization, since there was a neomembrane in the external canal interfering with the expulsion of the cholesteatomatous material. For this reason, in my opinion, the three cases of Peterson do not prove that buried epidermis produces a genuine cholesteatoma. More important are the reports of Fowler[9] and Lindsay,§ who noticed microscopically the formation of a cholesteatoma in monkeys after implantation of skin flaps into a cavity, performed for a fenestration of the horizontal semicircular canal. An apparently similar finding was obtained in the following case.

CASE 5.—J. R., a white man aged 24, complained of increasing deafness. For this reason a fenestration operation was performed on the right side on May 31, 1950. At operation the fenestra was covered with a skin flap, taken from the left arm. On June 10 the skin graft was markedly edematous and there appeared to be some blood accumulated under the graft. On June 11 the graft started to slough. On June 17 the cavity was filled with pus and the graft was sloughing. On June 21 a small granulation was cauterized. On June 28 the ear was nearly dry and the fenestra patent. On Aug. 1 the cavity was moist again; four

§ Lindsay, J., in discussion on Walsh.[10]

days later it was dry. On Sept. 11 there was a small amount of purulent discharge. He was sent to Arizona. There the discharge ceased for one year. When he returned, there was again discharge. On Dec. 4, 1952, the cavity was dry and epithelized, and remained so until July, 1953. At that time the Weber test was not lateralized, the Rinne test was negative on both sides, bone conduction was normal, and c_4 was heard normally on both sides. Conversational voice was heard 15/20 on both sides. Since July, 1953, the right ear has been discharging. There has been no headache and tinnitus only periodically. The hearing was markedly improved immediately after the operation and decreased somewhat one year later, and has remained at that level (Fig. 8).

At admission, on Aug. 25, 1953, the right middle ear and the right external canal were filled with cholesteatomatous masses and purulent discharge. Microscopic examination revealed the typical structure of cholesteatoma and the presence of cholesterol crystals. It took several days to remove the cholesteatomatous masses, when, finally, the following findings were revealed: The pars tensa of the drum and the malleus were normal. Mesial walls of the attic and antrum were covered by a white, thick, opalescent epidermis, which in the petrosal angle extended deeply into the bone. Tegmen antri and tegmen mastoideum were covered by granulations. In the area of the ampulla of the horizontal semicircular canal there was a shallow groove surrounded and filled with cholesteatoma, viz., the fenestra. There was no spontaneous nystagmus. The fistula test was positive for both pressure and aspiration. There was no vascular fistula symptom. On Sept. 8 x-ray examination showed pronounced pneumatization on the left side; on the right side the pneumatization was markedly diminished (Fig. 9). There was a copious discharge from the right ear. On Oct. 23, the ear was dry and epithelized. The fenestra was very easily seen, having distinct margins. The epidermis extended over the fenestra and was retracted toward the base of the fenestra. The fistula symptom was active. The hearing was essentially the same as on Nov. 5. There had never been an external otitis. On Dec. 29 there were again granulations on the tegmen tympani and in the region of the fenestra. There was a slight secretion. Methylrosaniline chloride was applied. It took several days until the cavity was dry.

When the patient was seen by me, the surgical cavity and the external canal on the right side were completely filled with cholesteatomatous masses and purulent secretion. After removal of the masses, no obstruction was noticed; but there was a granulating ostitis of the tegmen tympani and of the petrous pyramid above the fenestra. Thus the diagnosis of a cholesteatoma of the surgical cavity was established. Primarily, it seemed a fair conclusion that the cholesteatoma had originated from epidermis buried in the cavity.

However, a critical review of the case raises some objections to this conclusion. According to the history, a great part of the implanted skin flaps sloughed off. This, of course, does not imply that all the implanted flaps had sloughed off. The cholesteatoma may have originated from a small piece of implanted epidermis which had remained in situ. However, there are other objections. Immediately after the operation there was a discharge from the ear. This is not uncommon after this type of surgery. However, in Case 5 the discharge ceased and recurred for a period of three years, and there was no definite cure up to the time of writing. This is quite unusual after fenestration operations. It is likewise not usual in surgical infections. In such instances the inflammation usually takes an acute course, infrequently a chronic course, but never an intermittent course, as in Case 5. This would be more in agreement with a deep-seated inflammation of the middle ear, which had been present and probably escaped the notice of the surgeon. I have in mind an incipient cholesteatoma, which, according to Manasse,[5] Lange,[11] Steurer,[12] Oppikofer,[13] and others, develops in Shrapnell's membrane without causing clinical symptoms until it reaches a considerable

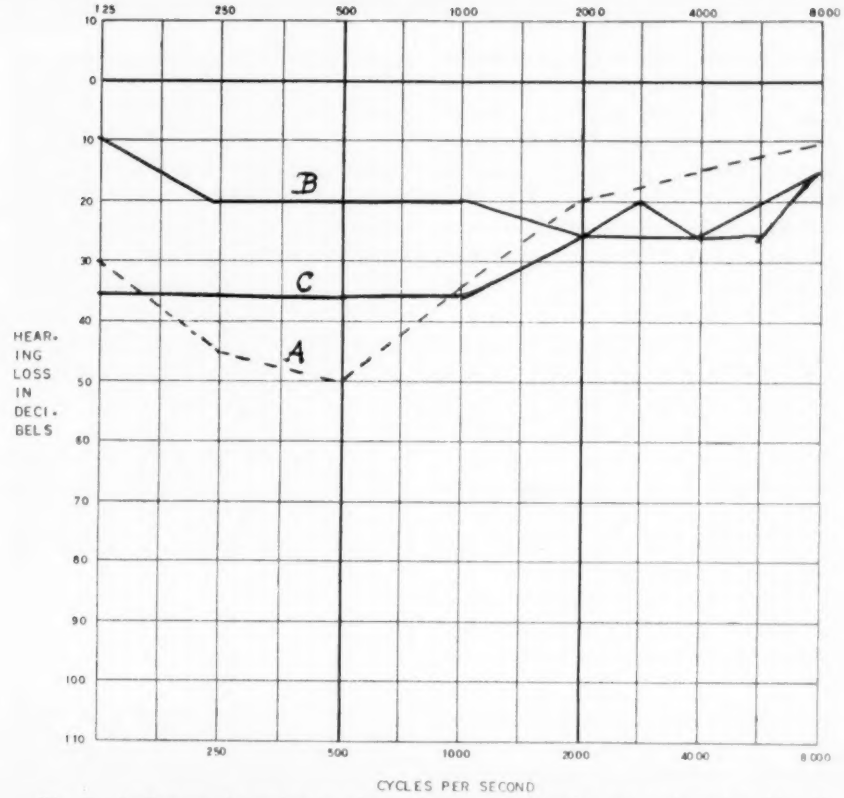


Fig. 8.—Audiogram of a patient on whom a fenestration operation was performed on May 31, 1950. Curve *A* was made on May 11, 1950; Curve *B* on Sept. 11, 1950; Curve *C* on Feb. 4, 1954.

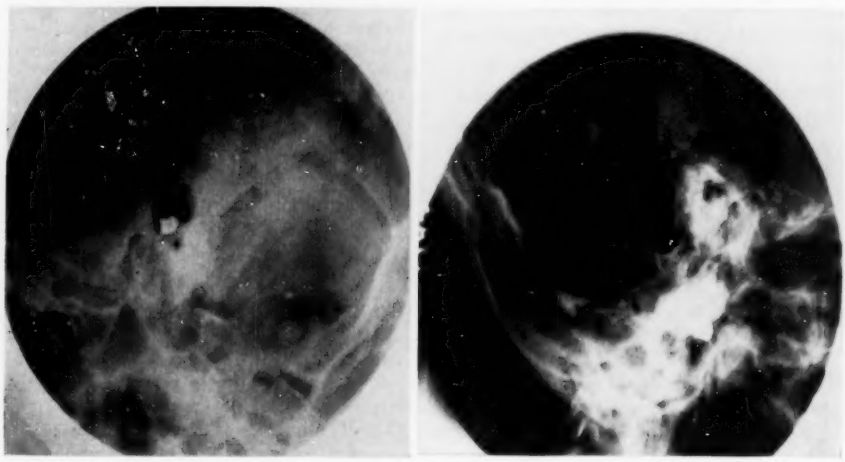


Fig. 9.—The two figures show the difference between the pneumatization on the right and left sides. The fenestration operation was performed on the side on which the pneumatization is markedly diminished. In the area of the fenestra there is a cotton pledget soaked with iodized oil (Lipiodol).

size.‖ A fenestration operation and a subsequent mild infection of the cavity could, hypothetically, give rise to a rapid expansion of the cholesteatoma, changing the latent stage into the manifest stage. In Case 5 the x-ray, which shows a highly pneumatized temporal bone on the left side and markedly diminished pneumatization on the right side, substantiates this concept.

Regardless of whether this concept is correct or not, the case proves (1) that in spite of a cholesteatoma of the middle ear the fenestra may remain patent and (2) that in spite of a cholesteatoma of the middle ear and a patent fenestra, labyrinthitis does not necessarily develop. However, the case does not prove definitely that epidermis buried in a radical cavity gives rise to the formation of a cholesteatoma. If such a condition occurs in the human ear at all, it is very rare.

From the point of view of prognosis, the recurrent cholesteatoma requires a different evaluation from the original cholesteatoma. In the recurrent cholesteatoma the danger to life is not as threatening as in the original cholesteatoma, because it usually takes a long time for recurrent cholesteatoma to extend into the labyrinth or into the meninges. The cholesteatoma usually drains spontaneously into the main cavity or forms large sacs, which bulge into the mastoid cavity, causing eventually a bulging of the retroauricular scar. Begley and Williams [14] have recently reported instructive cases of this type. Even in instances in which there is permanent discharge due to a recurrent cholesteatoma, the danger to life is less than in an original cholesteatoma. In fact, in the rare cases in which an intracranial complication originated from a radical cavity, it is by no means invariably a recurrent cholesteatoma which has caused the complication. Instructive in this respect is the following case, in which there was a recurrent cholesteatoma of 21 years' duration on one side and chronic otitis on the other side. The patient died of an otogenous temporal lobe abscess, which, however, did not originate from the recurrent cholesteatoma but from the chronic otitis on the other side.

Case 6.—The patient was 32 years old. When he was 11 years he had a radical mastoid operation on the right side. The radical cavity has never been dry.

Microscopically, the tube was covered by columnar epithelium. The anterior portion of the drum membrane was replaced by a neomembrane, which consisted of newly formed connective tissue and was covered on the outside by squamous epithelium. The connective tissue layer of the original drum membrane formed a structure similar to a wool ball, which was embedded in the newly formed connective tissue of the neomembrane. Another membrane branched off from the neomembrane, which may be called the "dividing membrane," because it extended through the tympanic cavity to the promontorium (Figs. 10 and 11). At the promontorium, it joined the tympanic mucosa, turned up toward the epitympanum, bridged the recess of the oval window, and merged with the connective tissue which obliterated the epitympanum. Since the dividing membrane extended from the opening of the tube back to the descending portion of the facial canal, the radical cavity was divided into a smaller, inferior compartment and a larger, superior compartment (Figs. 10 and 11). The inferior compartment included the recess of the round window; the walls were covered by columnar epithelium. It contained serous exudate and had no communication with either the external canal or the tube.

‖ Steurer [12] accidentally discovered among 500 temporal bones seven cases of incipient cholesteatoma. In agreement with other otologists, he emphasizes that the genuine cholesteatoma may remain in an incipient and latent stage for a long period of time until a mild stimulus, e. g., a mild infection of the ear, causes rapid progress of the cholesteatoma. Assuming that in Case 5 there was an incipient cholesteatoma to begin with, the fenestration operation could serve as a mild stimulus.

Fig. 10.—Section through external auditory canal (*E*), promontorium (*P*), and remnants of drum (*T*). There is a "dividing membrane" (*D*) in the tympanic cavity, which divides the cavity into an inferior part (*I*) and a superior part (*U*). The inferior part is filled with a serous-fibrinous exudate and covered by columnar epithelium. The superior part contains a cholesteatoma matrix, which forms a sac. The matrix bridges the oval window (*o*) and is grown together with both the dividing membrane (*D*) and the neomembrane (*N*), which is a continuation of the remnant of the drum membrane (*T*). The neomembrane shows defects; a few sections posteriorward it disappears entirely between *a* and *b*, and thus the cholesteatoma sac communicates freely with the external canal (*E*). The patient died 21 years after the radical mastoid operation.

The superior compartment included the opening of the tube, the recess of the oval window, and the antrum. It did not include the attic, which was obliterated by a loose, inflamed connective tissue. Within the superior compartment there was a cholesteatoma sac, which extended from the tube back into the antrum. At the opening of the tube the sac formed a cul-de-sac, which was adherent only to the connective tissue in the attic and had no connection with the other walls of the compartment. Approximately in the center of the mesotympanum the cholesteatoma sac had grown together with both the neomembrane and the dividing membrane. In the posterior portion of the middle ear the neomembrane, replacing the drum membrane, disappeared. With the neomembrane the wall of the cholesteatoma sac, which was adherent to the neomembrane, also disappeared. This resulted in a large communication of the cholesteatoma sac with the external auditory canal. The wall of the cholesteatoma sac presented itself as being the direct continuation of the skin of the superior wall of the external canal. The part of the sac wall which had grown together with the dividing membrane was intact. However, the part of the sac wall which had grown together with the mesial wall of the tympanic cavity showed many defects, which were filled with granulation tissue and covered with columnar epithelium (Fig. 11). Thus, in these areas columnar and squamous epithelium clashed. The result was infection, inflammation of the subepithelial connective tissue, purulent discharge, and granulation polypi, either covered by both squamous and columnar epithelium or devoid of epithelium. The infection in these areas had involved the underlying bone, resulting in an ostitis of the promontorium, of the facial canal, and, particularly, of the horizontal semicircular canal, which presented a large fistula. In the antrum the sac wall showed only a few defects, which were usually devoid of epithelium.

Case 6 illustrates a poor result of a radical mastoid operation. In this respect three findings are of importance: (1) the obliteration of the attic by inflamed connective tissue, (2) the neomembranes in the cavity, and (3) the recurrent cholesteatoma.

In my experience, an accumulation of connective tissue in the attic occurs if the surgeon has failed to remove all the necrotic bone or to take off the entire lateral wall of the attic. If an attic extends deep into the malar process, it is not possible to remove the most anterior portion of the lateral attic wall because of eventual damage to the mandibular joint. In these instances connective tissue forms in the most anterior part of the attic in an otherwise well-performed radical cavity. This usually does not impair the final result of the operation. But if the surgeon fails to remove the greater part of the lateral attic wall, almost the entire attic becomes obliterated by con-

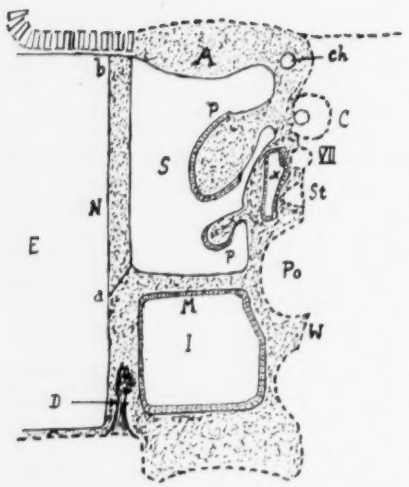


Fig. 11.—Diagram of section through the external auditory canal (*E*), the promontorium (*Po*), the round window (*W*), the stapes (*St*), the facial nerve (*VII*), and the horizontal semicircular canal (*C*), which shows a large fistula. The drum membrane is replaced by a neomembrane (*N*), which contains the remnants of the original drum membrane (*D*) and which is absent in the posterior portion of the middle ear between *a* and *b*. The tympanic cavity is divided by a "dividing membrane" (*M*) into an inferior part (*I*) and a superior part (*S*). The inferior part is covered by columnar epithelium. The superior part is covered by a cholesteatoma matrix, which in the area of the granulation polypi (*P*) shows defects filled with columnar epithelium; *x*, cyst in the recessus of the oval window, covered by columnar epithelium; *ch*, small pocket originating from the cholesteatoma sac in the superior part of the middle ear; *A*, attic filled with inflamed connective tissue and covered by the cholesteatoma matrix.

nective tissue. This is contrary to the purpose of the radical mastoid operation, which aims not at obliteration but at exposure and epidermization of the cavities. Obliteration of the cavities invites infection of the connective tissue and eventually formation of a recurrent cholesteatoma. In Case 6 the entire attic was obliterated by connective tissue because the surgeon probably failed to remove all ostitic bone from the attic.

Neomembranes form in narrow cavities when granulations originating from two opposing walls fuse. Most frequently neomembranes form in the aditus ad antrum, sealing off the antrum from the rest of the cavity, or in the external canal, lateral to the annulus tympanicus, sealing off the entire cavity from the external canal. From the theoretical point of view, the formation of a neomembrane in the external canal should more frequently occur subsequent to a endaural operation than to a retroauricular approach.

In the presented series of 11 cases, neomembranes were noticed in 2. In Case 6 there was a newly formed membrane, which was divided in two parts: one part had replaced the anterior portion of the drum, and the second had shut off the hypotympanum from the rest of the cavity (Figs. 10 and 11). The latter membrane, "the dividing membrane," is of particular interest, because in the past some otologists have suggested sealing off the hypotympanum intentionally by encouraging the formation of a dividing membrane. For this purpose they have forced the inferior part of the drum membrane toward the promontorium by means of a tampon in order to achieve a fusion of the drum membrane and the mucosa of the promontorium. From my experience, I am not in favor of this procedure. A dividing membrane which occludes the hypotympanum prevents the inspection of this cavity, and a dividing membrane which occludes the tube is not effective, because it ruptures if there is an infection of the tube.

The recurrent cholesteatoma was of long standing in Case 6. In addition, there was a severe inflammation, resulting in the formation of granulation polypi; there was a great amount of columnar epithelium, and the cavity was considerably reduced in size, owing to the obliteration of the attic and the separation of the hypotympanum. Never-

theless, the intracranial complication did not originate in this cavity but arose from the chronic otitis on the other side. Concerning the fistula of the horizontal semicircular canal, it cannot be stated whether it was present prior to the operation or whether it developed after the operation. Considering the fact that 21 years have elapsed since the operation, it is most likely that the fistula developed after the radical mastoid operation.

Cholesteatomas of a radical cavity which are actually newly formed are usually small and have a definite tendency to heal spontaneously. Cleansing of the cavity and local application of antibiotics is all that is needed to achieve a cure. An exception is Case 5, in which a newly formed cholesteatoma reached a considerable size; however, in this case it is not quite definite that the cholesteatoma actually was newly formed in the radical cavity.

In the usual type of recurrent cholesteatoma, viz., in the cholesteatoma which develops subsequent to an incomplete mastoid operation, a revision operation has to be frequently performed in order to complete the original operation. The revision operation is not urgent in these cases. This is evidently confirmed by Case 6. One must keep in mind that a recurrent cholesteatoma is not as dangerous as an original cholesteatoma and that the operation of a recurrent cholesteatoma is, from the technical point of view, more difficult than the operation of an original cholesteatoma. Postoperative labyrinthitis and postoperative facial paralysis are more frequent in recurrent cholesteatoma than in original cholesteatoma. Figures 2 and 11 illustrate this point.

CONCLUSIONS

1. The epidermization of the attic-antrum is the most frequent result of the radical mastoid operation if all ostitic bone has been removed, if the lateral attic wall is taken off down to the insertion of the malar process, and if an overgrowth of granulations has been prevented by proper after-care.

2. If prior to the operation there was a cholesteatoma in the mesohypotympanum, parts of the matrix—at times the entire matrix—are spontaneously cast off after the operation. For this reason the complete removal of the matrix from the walls of the mesohypotympanum is not necessary. It is also not feasible.

3. If the cholesteatoma matrix is intact and continuous, it is rather the exception than the rule to preserve the matrix, because beneath a grossly intact matrix there may be cysts containing exudate or an ostitis or evaginations of the main cholesteatoma sac.

4. The complete removal of columnar epithelium from the mesohypotympanum is even less feasible than the complete removal of squamous epithelium.

5. Reinfections of a well-epidermized radical cavity are not alarming and respond well to local treatment.

6. The tube and the peritubar marrow spaces are not the only sources of reinfection of a radical cavity. In my opinion, the columnar epithelium is the chief source of reinfection.

7. It is not always possible to state the reason for the expansion of the columnar epithelium subsequent to a radical mastoid operation.

8. For the diagnosis of a recurrent cholesteatoma in a radical cavity the involvement of the underlying bone must be proved.

9. The new formation of a cholesteatoma in a radical cavity is not frequent. The majority of recurrent cholesteatomas in a radical cavity are due to an in-

complete operation on the bone in a case of cholesteatoma and/or an incomplete removal of a cholesteatoma. The operation on the bone is of prime importance.

10. There is no definite proof that human epidermis buried in a radical cavity gives rise to the formation of a cholesteatoma.

11. The danger to life is not as great in recurrent cholesteatoma as in original cholesteatoma.

12. Postoperative labyrinthitis and postoperative facial paralysis are more frequent in recurrent cholesteatoma than in original cholesteatoma.

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LYMPHOMAS OF THE NASOPHARYNX AND PHARYNX

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THE INITIAL manifestation of certain lymphoid disorders may be a tumor of the nasopharynx or pharynx. At the present time there seems to be no accurate way of predicting the subsequent behavior of the varying types of lymphoid tumors which appear in this area. The basis of this report is an analysis of the clinical and pathological data on 10 patients whose presenting symptoms were referable to this region and in whom there was discovered a primary lymphomatous neoplasm of the pharynx, with no simultaneous evidence of systemic involvement or of disease elsewhere in the body.

GENERAL CONSIDERATIONS

Pathologists have long been concerned with the etiology and pathogenesis of the various lymphoid diseases. The lack of any sharp features of distinction among these conditions has led to current efforts to link them broadly under the heading "malignant lymphoma." Craver has pointed out the desirability of considering lymphosarcoma along with Hodgkin's disease and has further indicated the considerable disagreement which may arise among pathologists as to whether a given lymphosarcoma represents a lymphocytic or a reticulum cell type.[1] In Symmers' monograph the designation "lymphoid diseases" is used to include Hodgkin's disease, giant follicular lymphadenopathy, lymphoid leukemia, and lymphosarcoma.[2] Symmers believes that all these diseases are initiated by hyperplasia of lymph follicles, usually of the deeper lymphoid structures, and that enlargement of superficial nodes is seldom preponderant or primary, but occurs as a later development.

We concur in the propriety of a general classification of these disorders. Confronted with the material at hand, however, we have endeavored to identify the tumors in our series, to classify them, so far as this is possible, and thereby to relate the clinical and pathological aspects of this particular group of lymphoid tumors of the pharynx.

REPORT OF CASES

Giant Follicle Lymphoma

Case 1.—S. W., a 19-year-old white woman, had been troubled by deafness for several months prior to November, 1951. Adenoidectomy had been performed elsewhere three months previously

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because of this symptom, but no tissue studies had been made. Examination revealed that the tympanic membranes were retracted. There was bilateral conduction deafness, along with an abundant mass of abnormal-appearing nasopharyngeal lymphoid tissue.

Biopsies were reported as showing suspicious evidence of lymphosarcoma, with a request for more tissue. The entire mass was removed by adenoidectomy, and a diagnosis of giant follicular lymphadenopathy was proposed. There were no abnormalities of the blood count or any generalized lymph node or splenic enlargement.

She was given deep roentgen therapy (3,000 r through each of two portals to the nasopharynx and 2,200 r to an enlarged left cervical node), with resulting complete disappearance of the lymphoid enlargement.

Microscopic Study.—Microscopic examination of the large fragments of tissue from the nasopharynx showed an extreme degree of hyperplasia of lymphoid tissue. The lymphoid follicles were very large, and there was active mitotic division within the germinal centers. The structural relations of the follicles were not abnormal. At the periphery of the follicles there were solid accumulations of lymphoid cells which occupied the interfollicular spaces. In some regions the follicles were entirely lacking. Mitotic division of interfollicular reticular cells was not conspicuous. Highly atypical neoplastic cells were not found. Though there was migration of lymphocytes and polymorphonuclear cells through the surface epithelium, no necrosis or ulceration was encountered.

This extreme degree of hyperplasia with partial retention of follicular structure was in keeping with that encountered in lymphomas of the giant follicular type, but this process had best be regarded as a non-neoplastic hyperplasia of lymphoid tissue modified by a local chronic inflammatory excitation.

Subsequent Course.—The patient reported for several months after completion of roentgen therapy. Her symptoms subsided, and there was no evidence of any further lymph node enlargement. Unfortunately, she has not been seen for one year, and efforts to locate her have been unsuccessful.

Comment.—This case illustrates a type of lymphoid hyperplasia in which the follicles are enlarged and their architecture is preserved in some areas but missing in others. It may be, as Symmers has stated, a toxic or an inflammatory disease which is potentially capable of malignant transformation. The distinction between inflammatory hyperplasia and tumor formation is often tenuous. There are certain parallelisms between Hodgkin's disease and giant follicle lymphoma.

The response to radiation therapy is excellent and the survival rate is fairly high, particularly when only a localized form of the disease is present. It is probable that this case represents one of the more benign forms of lymphoma.

Malignant Lymphoma, Lymphoblastic Type

Case 2.—N. B., a 55-year-old woman, had noticed discomfort in the left side of her throat for one month prior to October, 1951. She had a genuine cancerphobia, aggravated by the recent death of a close relative from a malignant tumor of the pharynx. On examination there was observed a nonulcerated, homogeneous enlargement of the left tonsil and an enlarged deep cervical node at the carotid bifurcation on the same side. The Kahn test was negative. A complete blood count was within normal limits. The chest roentgenogram was normal. There was no liver, splenic, or generalized lymph node enlargement.

Biopsy was reported as indicative of lymphosarcoma of the tonsil. A tumor dose of 3,500 r was given to the left tonsillar region, resulting in disappearance of the enlargement, atrophy of the tonsil, and disappearance of the solitary cervical node.

Microscopic Study.—Microscopic study of the pieces of tissue from the tonsil showed an intact stratified squamous epithelium which covered hyperplastic lymphoid and neoplastic tissue. Numerous hyperplastic lymphoid follicles with normal germinal centers were present in some microscopic fields. The intervening lymphoid tissue showed little or no pathological change, but there were transitions between the normal follicles and an abnormal type of follicle, in which the

central structure was replaced by a random orientation of immature lymphoblasts that permeated the periphery of the follicle and the intervening tissue (Fig. 1). In connection with this obliterative spread of immature cells, there was hyperactivity of the interfollicular reticulum. Mitotic figures were common, and occasional anaplastic large cells were found. The immature cells completely obliterated follicular structure in some areas and spread to the neighboring tissues beyond the normal limits of lymphoid structure. The diagnosis of malignant lymphoma seemed evident. There were more of the characteristics of a lymphoblastic type than of the reticulum cell type.

Subsequent Course.—This patient has remained completely well for 30 months, as of April, 1954, with return of her weight to normal. She is being carefully observed for any local or systemic evidence of malignant lymphoma.

Comment.—Initial involvement of the pharynx or tonsillar area has been thought by some authors to indicate that an infectious agent commonly enters through this

Fig. 1 (Case 2).—Biopsy section of left tonsil, showing variations in the size and cellular composition of lymphoid follicles, together with hyperplasia of interfollicular reticulum. Malignant lymphoma, lymphoblastic type.

area. If the patient in this case should remain free from generalized lymphomatous disease, the role of infection in her abnormal tonsillar hyperplasia would merit reevaluation. As in Case 1, the future behavior, rather than the histological examination, will probably determine the ultimate classification of this lymphoma. Gall and Mallory have pointed out that nothing in the histologic character of an individual lesion will permit a reliable forecast as to the distribution of the process in other parts of the body.[3]

Malignant Lymphoma, Lymphocytic Type

Case 3.—F. S., a 73-year-old white man, had noticed loss of hearing for six months and nasal obstruction for three months prior to December, 1950. The latter symptom had been accom-

panied by slight bleeding. A watchmaker by trade, he had always enjoyed good health. Systemic inventory disclosed no other symptoms of importance.

On examination, a nasopharyngeal mass could be seen through the left nasal fossa. This mass filled the entire nasopharynx and extended inferiorly behind the left posterior tonsillar pillar (Fig. 2). The surface mucous membrane was intact. There was bilateral conduction deafness, with inability to hear either the whispered or the spoken voice *ad concham*. The tympanic membranes were retracted. There were multiple firm cervical lymph nodes, varying from 0.5 to 1.0 cm. in diameter.

Laboratory data disclosed a completely normal blood cell count and differential count. The Kahn test was negative. Chest roentgenograms and basal skull views were normal.

Three biopsies of the nasopharynx showed loss of normal architecture, with overgrowth of reticuloendothelial calls. A cervical lymph node biopsy was reported to reveal lymphoblastoma.

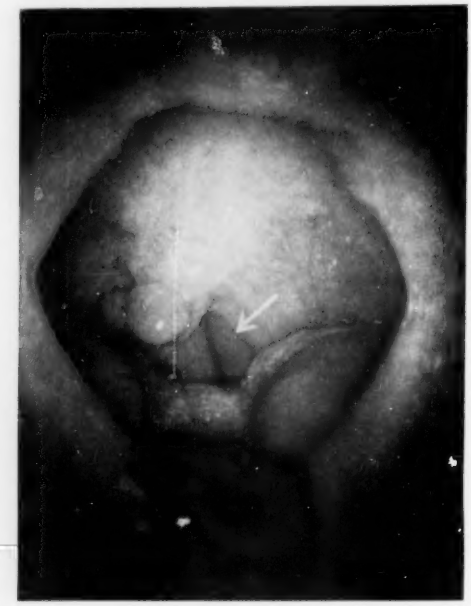

Fig. 2 (Case 3).—Tumor involving lateral pharyngeal wall on left side. The nasopharynx was filled with tumor tissue, and the overlying mucosa was intact. Malignant lymphoma, lymphoblastic type.

The patient received 1,500 r each to right and left facial portals and 2,200 r to the left side of the neck, with subsidence of all evidence of tumor in the nasopharynx and cervical nodes.

Microscopic Study.—Microscopic study of the biopsy specimen from the pharynx showed an interrupted ulcerated layer of stratified squamous epithelium which overlay abnormal lymphoid tissue. The base of the ulcer was covered with a necrotic layer of fibrinopurulent exudate, which was fused to the subjacent lymphoid tissue. This tissue was composed of small round cells which, except for a slight irregularity in contour, closely resembled mature lymphocytes. The cells were well separated from one another and uniformly distributed, except in the region of one lymphoid follicle. Mitotic figures were rare and normal in type. No cells clearly distinguishable as neoplastic cells were found.

It seemed likely that this tumor was a malignant lymphoma of the lymphocytic type, though it was recognized that the process might be benign in nature.

Subsequent Course.—The patient has remained well for over three years and, as of April, 1954, has had no recurrence of symptoms. He is being carefully observed in another city at monthly intervals.

Comment.—The clinical course of this patient, along with that of Case 2, would thus far seem to support Sugarbaker and Craver's contention that lymphosarcoma may be of monocentric or multicentric origin.[4] Certainly, the pathological material on these patients appeared to be highly malignant, and yet the disease was apparently recognized early and was localized in the pharynx. One must realize that an apparent cure is possible but that, as will be seen subsequently, the lymphomas are much more likely to terminate fatally.

Fig. 3 (Case 4).—Pharyngeal mass behind posterior tonsillar pillar on right side. The tumor extended from the epipharynx to the tip of the epiglottis. Malignant lymphoma, lymphocytic type.

CASE 4.—Z. C., a 57-year-old white woman, was first seen in February, 1950, because of a slight change in the quality of her voice, a sensation of dryness in the throat, and postnasal discharge.

There was a mass involving the right lateral pharyngeal wall, extending from the epipharynx to the tip of the epiglottis (Fig. 3). An aspiration biopsy specimen was reported as a benign lymphoma of the pharynx. An incisional biopsy specimen was interpreted as a benign lymphoma of an atypical type. There were no cervical node enlargements, and a complete blood count was normal. Roentgenograms of the chest were normal. The patient received 3,000 r to the involved area of the pharynx, with complete disappearance of the mass.

The patient continued to lose weight until her first hospital admission, in November, 1950. At that time she was experiencing pain in the right upper chest, cough, and night sweats. A chest film revealed atelectasis of the right lung, and bronchoscopy disclosed almost complete occlusion of the proximal portion of the right main bronchus. Biopsy revealed lymphomatous tumor tissue,

comparable to that obtained originally from the pharynx. Roentgen therapy to the right hilar region was followed by clearing of the lung fields and a negative bronchoscopy two months later.

Fever, malaise, and daily chills necessitated the third hospital admission, in April, 1951. There was a severe anemia, and the patient's liver was markedly enlarged. Blood cultures, agglutination tests, and sternal punctures were nonrevealing. The patient's temperature gradually returned to normal after four blood transfusions. Roentgen therapy (2,000 r) was directed to the enlarged liver.

The fourth hospital admission, in August, 1951, followed the same pattern as the third, except that nitrogen mustard therapy was administered.

In November, 1951, the patient developed nausea, vomiting, and left-sided convulsive seizures. Physical and laboratory studies were not remarkable except for a persistent anemia.

On the final admission, in January, 1952, cachexia and jaundice were evident. The liver was enlarged, tender, and nodular. There was a severe anemia. The patient was given corticotropin

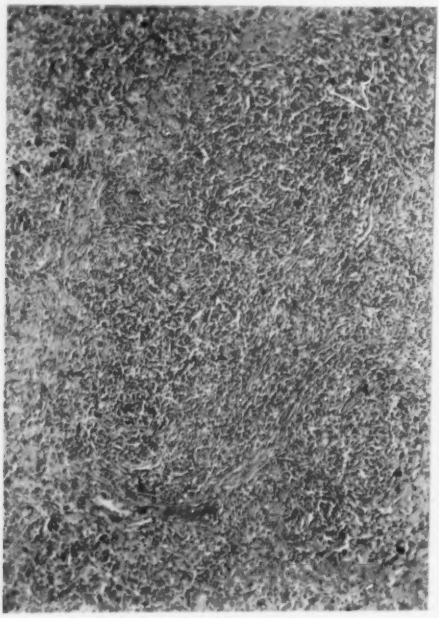

Fig. 4 (Case 4).—Tissue removed at autopsy from original tumor site in nasopharynx. There is extensive fibrosis and hyaline degeneration with a few isolated clusters of lymphocytic neoplasia, persisting despite extensive treatment with x-rays and nitrogen mustard.

and nitrogen mustard, along with blood transfusions. Her condition deteriorated rapidly, and she died exactly two years after the onset of symptoms.

Microscopic Study.—Microscopic study of the original pharyngeal tumor showed an intact layer of stratified squamous epithelium which overlay abnormal lymphoid tissue. The lymphoid tissue was distributed uniformly throughout the section. There were no follicles or sinuses. The cells were small and resembled mature lymphocytes. Mitotic figures were rare. There was no evidence of inflammation.

It was difficult to be certain about the diagnosis, but the possibility of a malignant lymphoma of a mature lymphocytic type was seriously considered. This consideration was based entirely upon the abnormal pattern of cellular distribution and not at all upon the presence of abnormal types of cells. It was finally decided by pathologists in consultation that the process was neoplastic.

Necropsy.—A small mass was present beneath the mucosa of the oropharynx on the right side, and this seemed to fuse with the surrounding tissue. Grossly it appeared to resemble fibrous tissue. There was some enlargement of the mesenteric lymph nodes. The bone marrow was grossly normal.

Microscopic study disclosed essentially identical changes in the nasopharyngeal mass and in the greatly enlarged retroperitoneal lymph nodes (Fig. 4). These tissues were composed principally of delicate homogeneous fibrous tissue with some hyaline degeneration. Interspersed in the spaces between the meshwork of fibrous elements were clusters of cells. Many of these were endothelial in nature and tended to form small sinusoidal spaces. Other cells were larger and more atypical in detailed structure, resembling neoplastic reticulum cells or lymphoblasts. Very few lymphocytes remained, and there was no recognizable pattern of lymphoid follicular or sinusoidal structure. These findings were similar to those encountered in the various forms of malignant lymphoma which have responded satisfactorily to treatment with irradiation or nitrogen mustard.

In addition, there was aplasia of the bone marrow, with complete suppression of myelopoiesis and erythropoiesis.

The conclusion was reached that the disease was being effectively eliminated by the therapy which was used.

Comment.—The complete replacement of all normal-appearing lymphoid structures in the original biopsy specimen from the pharynx was evidence of a fairly high degree of malignancy and probably should not have been interpreted as indicating a benign lymphoma, although there was some evidence to support such an opinion. However, this illustrates the difficulties encountered in the diagnosis and prognosis in many of these cases.

The histopathology in this case bore a close resemblance to that seen in Case 3, yet the clinical course was much more malignant.

Continuing weight loss and anemia pointed to developing foci of disease elsewhere in the body after regression of the pharyngeal tumor. These areas responded readily to irradiation and other measures, to the extent that lymphomatous neoplasia was found only in the original nasopharyngeal mass and in a few retroperitoneal nodes at autopsy. The suppression of bone marrow function incident to therapy was doubtless responsible for the fatal outcome.

Malignant Lymphoma, Lymphoblastic Type

Case 5.—J. K., a 10-year-old boy, became ill in December, 1947. Headache was the first symptom, followed shortly by nasal obstruction, discharge, and noisy breathing. A diagnosis of enlarged adenoids was suggested, although adenotonsillectomy had been performed eight years previously. In April, 1948, five months after onset of symptoms, a diagnosis of malignant lymphoma was made, on the basis of nasopharyngeal biopsy. Roentgen therapy (amount unavailable) was given, without improvement.

In May, 1948, the patient's symptoms became severer and included head pain, listlessness, and vomiting. The pain seemed to follow a trigeminal distribution on the left side. There had been a weight loss of 10 lb. (4.5 kg.) in the month prior to admission.

There was a history of polyarthritis following scarlet fever. The boy had sustained numerous accidental injuries, including fractures and lacerations between the ages of 4 and 10. His father had died at the age of 34 of a brain tumor, and there was a history of cancer on both sides of the family.

Physical Examination.—Marked lethargy, nasal obstruction, and purulent discharge were evident. The mouth and lips were dry. The soft palate was displaced forward and downward by a large mass which filled the nasopharynx and extended below the posterior palatal margin. The surface of this mass was ulcerated. There was serous fluid in the left tympanum. There were multiple pea-sized nodules in the anterior and posterior triangles on both sides of the neck. The

ocular fundi were normal. There was loss of sensation to sharp pain over the areas supplied by the second and third divisions of the trigeminal nerve on the left side. The liver and spleen were not enlarged.

There was a moderate anemia, but the differential blood cell count was normal. Roentgenograms of the chest and the base of the skull were normal.

With the patient under general anesthesia, the palate was elevated with a retractor, and all visible tumor tissue was removed from the nasopharynx with adenotome and punch forceps (for relief of obstructive symptoms). Microscopic sections revealed malignant lymphoma of the pharyngeal lymphoid tissue with a superimposed chronic inflammatory reaction.

There was no appreciable alteration in the clinical picture following operation. Pain persisted, with swallowing and breathing only slightly improved. The patient was referred to his doctor in another city for palliative roentgen therapy.

Microscopic Study.—Microscopic examination of tissue removed from the nasopharyngeal region showed a diffuse neoplastic process. The epithelium of the mucosa had been destroyed by an ulcerative process. The base of the ulcer was covered by a thick layer of fibrin enclosing many polymorphonuclear cells. This membrane was adherent to the subjacent, partly necrotic neoplastic tissue. The neoplastic cells were of uniform size and shape. They were individual, spherical, and about the size of large lymphocytes or lymphoblasts. There were numerous mitotic figures. Mature lymphoid cells were absent, and there was no trace of lymphoid follicle structure. The neoplastic cells had spread widely throughout the regional fibrofatty, glandular, and muscular tissue. The cytology of this tumor was in keeping with that of acute leukemia of childhood or malignant lymphoma of the lymphoblastic type. In view of the absence of hematologic or other diagnostic indications of acute leukemia, the latter diagnosis was indicated.

Subsequent Course.—The boy's condition became progressively worse. He became comatose shortly after his return home and died six months after the onset of symptoms. Permission for necropsy was not obtained.

Comment.—This case represents an acute, highly malignant form of lymphoma which arose in the nasopharynx. There was rapid local growth, ulceration, and probable invasion of the adjacent central nervous system. The pathological studies indicated a greater degree of undifferentiation in this case than in any of the preceding four cases. Invasion of regional tissues was a prominent feature. Among the factors outlined by Sugarbaker and Craver as influencing the course of lymphosarcoma, the "individual inherent qualities for growth and dissemination" are regarded as the most important and probably the least definable.[4] In this instance the patient's age and the suggestive leukemic-like infiltration were also of detrimental prognostic significance.

Malignant Lymphoma, Hodgkin's Type

Case 6.—G. K., a 70-year-old man, had noticed a sore throat for five weeks, associated with a bad taste in the mouth. He had experienced daily chills during the week prior to admission. Examination disclosed hypertrophy and ulceration of the left tonsil, with extension beyond the midline just posterior to the uvula (Fig. 5*A*). There were two small nodular protrusions on the anterior pillar inferiorly. There was no induration of the diffusely enlarged tonsil. There were multiple palpable small lymph nodes extending from the supraclavicular area on the left to the angle of the mandible. The right tonsil was the site of several ulcerative lesions. There was no generalized lymphadenopathy.

The chest roentgenogram was negative, as was the Kahn test. The blood cell count was characterized by a slight anemia. Two biopsies of the tonsillar mass were reported as suggestive of Hodgkin's disease. Irradiation therapy resulted in complete regression of the tonsillar mass and disappearance of the cervical nodes (Fig. 5*B*). Approximately one month after the completion of irradiation therapy, a 1 cm. lymph node was discovered in the right axilla. This was removed and was reported as showing Hodgkin's disease of lymph nodes. The patient's clinical course deteriorated rapidly, and he died exactly two months after the first visit to the clinic. Permission for necropsy was not obtained.

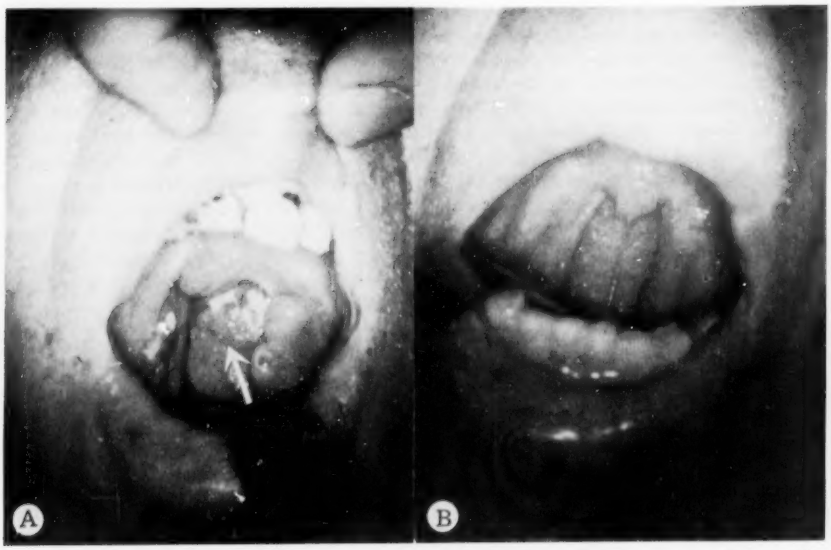

Fig. 5 (Case 6).—*A*, enlargement and ulceration of left tonsil. The arrow points to the middle of the left tonsillar mass. Note displacement of uvula. The medial border of the mass almost meets the right posterior tonsil pillar. The right tonsil also shows several superficial ulcerative lesions. Malignant lymphoma, Hodgkin's type. *B*, photograph taken during irradiation therapy, showing complete regression of the tumor (*A*). The epithelial reaction to irradiation is evident in both tonsil fossae. The extreme radiosensitivity of the lymphoma group is apparent.

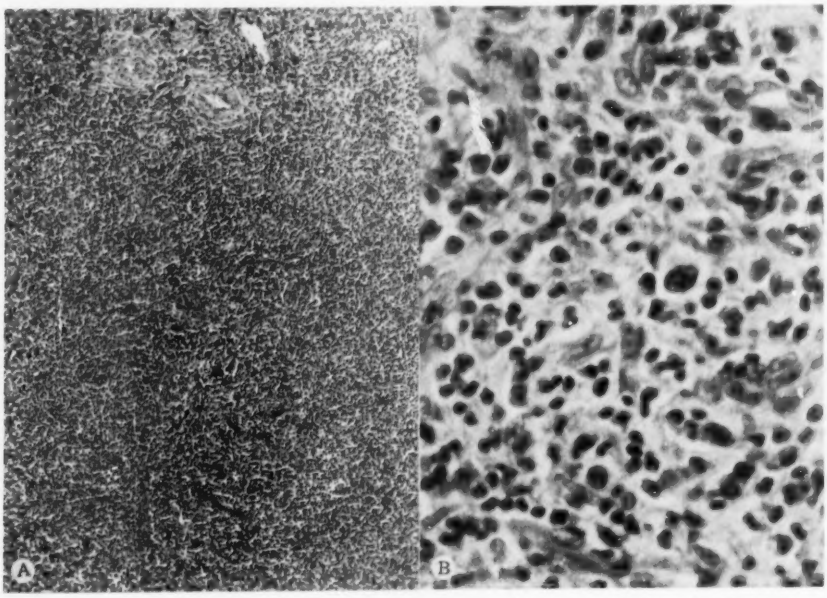

Fig. 6 (Case 6).—*A*, biopsy section of tonsil, showing absence of organized lymphoid tissue. The preponderant cell type is the eosinophile. Hodgkin's disease of tonsil. *B*, higher magnification of a field of *A*, showing cells of reticular type, immature lymphocytes, and a central tumor giant cell resembling a Dorothy Reed cell.

Microscopic Study.—Microscopic study of tissue from the tonsil showed stratified squamous epithelium with subacute ulceration extending down into a peculiar tissue. This tissue had a fairly uniform composition over broad areas. There was no trace of organized lymphoid tissue (Fig. 6*A*). The basic structure was a delicate collagenous stroma, rich in capillaries. Scattered throughout this structure were myriads of eosinophiles. Cells of less numerical importance were scattered about individually or in small compact clusters. These cells varied in size and shape and appeared to be of reticular origin (Fig. 6*B*). Few mitotic figures or large anaplastic cells of the Dorothy Reed type were encountered. Mature cells of the lymphoid series were rare.

This condition was an unusual neoplastic process. There was little question that it belonged to the group of malignant lymphomas. It was apparent that the neoplastic elements had been largely obliterated by a subacute sclerosing inflammatory process in which there was an abundance of eosinophiles. The general impression was that this could best be classified as a malignant lymphoma of the Hodgkin's type.

Comment.—The complete absence of any organized lymphoid structure in the tonsillar biopsy specimen gave some indication of the degree of malignancy in this case. As in most malignant lymphomas, the response of the primary lesion to irradiation was immediate and complete and was followed by the appearance of a new area of involvement. The absence of any Sternberg-Reed cells was not regarded as particularly significant in the light of the well-known variation of this finding in different stages and foci of the disease. There was little similarity between this process and that encountered in other cases of this series.

Malignant Lymphoma, Reticulum Cell Type

Case 7.—F. N., a housewife aged 44, noted a painless nodule in her neck three months prior to seeking medical advice, in February, 1941. She had been fatigued and had lost 7 lb. (3.2 kg.). Postnasal examination disclosed a mass resembling adenoid tissue, a biopsy of which was reported as showing an inflammatory origin. An adenoidectomy was done, along with removal of one of a series of discrete mobile, nontender nodes in each side of the neck. These tissues were reported as diagnostic of reticulum cell sarcoma of the nasopharynx and cervical lymph nodes.

The patient received roentgen therapy, after which the nasopharyngeal and cervical enlargements disappeared completely. She had no further symptoms for five years (until May, 1946), when she had pneumonia, with vague chest pain and occasional wheezing respiration. Bronchoscopic examination was negative, but a chest roentgenogram showed a left hilar shadow. Because of this, roentgen therapy was given to the left hilar region.

In February, 1948, a left supraclavicular and an inguinal lymph node were removed and reported as lymphosarcoma. In June, 1949, the patient entered the hospital for nitrogen mustard therapy. There was marked anemia, with a normal differential blood cell count.

In May, 1950, a soft tissue mass was removed from the right occipital region, and this resembled the previously diagnosed reticulum cell sarcoma.

One year later (May, 1951) the patient became aware of pain in the left side of the neck, with associated dysphagia. An ulcer was observed along the left lateral wall of the pharynx, beginning at the tonsillar level and extending into the pyriform sinus. A biopsy of the edge of this ulcer was reported as showing no tumor. The patient reentered the hospital with emaciation, ulceration of the pharynx, and a normal larynx. Bone marrow studies and chest roentgenograms were reported as normal. A gastrostomy was performed for feeding purposes.

The patient's final hospital admission was on Sept. 20, 1951. She died on Sept. 28, almost 11 years after her first symptoms were noted.

Microscopic Study.—Microscopic study of the original biopsy specimen from the nasopharynx showed abnormal lymphoid tissue. The general pattern of follicular and sinusoidal structure remained. The follicles were abnormal in that they consisted of cells which resembled lymphoblasts, and the usual normal gradient of maturation at the periphery of follicles was missing. In the interfollicular areas there were many immature reticulum cells in active and mitotic division. These cells were also present in masses in the sinuses and lymphatics (Fig. 7).

Also, there were local areas of fibrosis, rather well demarcated from the regional zones of active cellular proliferation. At times, in these areas and elsewhere, there were large atypical reticulum cells which resembled Dorothy Reed giant cells.

The various other tissues removed from this patient over a 10-year period were very similar histologically. The over-all appearance, however, was indicative of a malignant lymphoma with some features of the lymphoblastic and reticulum cell types.

Necropsy.—There was gross evidence of irradiation necrosis and ulceration of the left pharyngeal wall; lymphosarcoma of the liver and spleen; marked emaciation; ulceration of the trachea, the esophagus, and the surgical gastrostomy stoma, and irradiation atrophy of the skin and the tissues of the neck and groin.

Lymphosarcoma of the liver and spleen was also apparent histologically. There was no evidence of aplasia of the bone marrow.

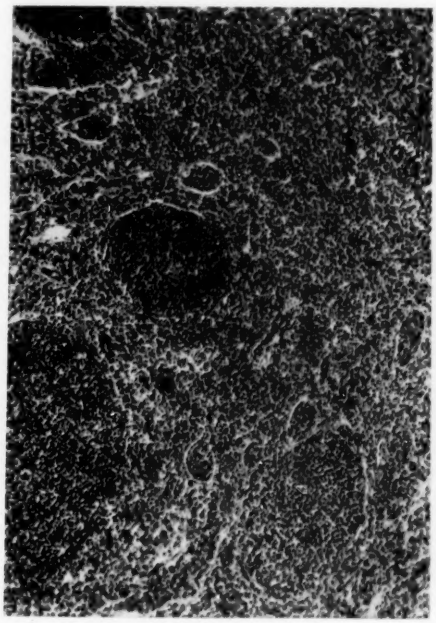

Fig. 7 (Case 7).—Biopsy section of nasopharynx, showing many immature reticulum cells in the interfollicular areas and the lymphatic sinuses. Reticulum cell sarcoma.

Comment.—As we sought an explanation for this patient's 11-year survival, the general pattern of retained follicular and sinusoidal structure in lymphoid tissue became significant. The response to various therapeutic measures was satisfactory, although here, as in Case 4, one gained the impression that the fatal termination was the result of the therapy employed for the control of the primary disease. The histopathology in this situation differed from that of other cases in the series. The microscopic changes in some areas resembled those occasionally found in acute infectious mononucleosis. The process was far less anaplastic than that encountered in the other cases.

CASE 8.—W. M., a 47-year-old white housewife, was referred to the otolaryngology clinic in May, 1948, because of headache, which had been continuously present following a cerebral

hemorrhage three years previously. This vascular accident had resulted in a persistent left hemiplegia. There were no symptoms referable to the nose or throat. The patient was known to have chronic rheumatic heart disease.

On routine examination of the upper passages, an enlargement of the left tonsil, with considerable redness and induration, was discovered. The tumor area measured 2 by 3 cm., and there was a palpable node in the left anterior cervical triangle. Biopsies of the tonsil and of the left cervical node were reported as showing lymphosarcoma, probably of the reticulum cell type.

Irradiation therapy was instituted in June, 1948, followed by complete regression of both enlargements. A rather severe reaction to roentgen therapy produced edema of the larynx, necessitating tracheotomy in December, 1948. It was possible to remove the tracheal cannula in April, 1949, but at that time a mass appeared in the right axilla. The spleen and liver were enlarged.

Fig. 8 (Case 8).—Cervical lymph node, partial obliteration of follicular pattern. The outlines of a few follicles may be noted, but the intervening neoplastic tissue predominates. Reticulum cell sarcoma.

The patient was admitted to Cook County Hospital, where she died in August, 1949, approximately 15 months after the diagnosis of lymphosarcoma was established.

Microscopic Study.—The small pieces of tissue from the tonsil consisted of stratified squamous epithelium, skeletal muscle, and neoplastic tissue. The cytology of the neoplastic tissue was modified by crushing incidental to the surgical procedure. Some groups of cells, however, remained undisturbed. These were about the size of normal reticulum cells and, though closely associated in clusters, were separated from one another. There was no definite structural pattern. The neoplastic cells had invaded muscular and fatty tissues. No normal lymphoid tissue or significant accumulations of lymphocytes were present in the biopsy specimens. The most likely diagnosis was reticulum cell sarcoma.

Microscopic study of the biopsy specimen from the cervical lymph node showed no structure other than neoplastic lymphoid tissue. The low-power view showed many primary and secondary follicles amid an obliterative spread of neoplastic tissue, which at times merged with the expanded,

undemarcated follicular structure (Fig. 8). The usual orderly arrangement of central germinal cells and peripheral mature cells was lacking. Instead, the follicles were composed of rather small reticulum cells or lymphoblasts oriented at random. These local concentrations of immature cells blended into an extensive diffuse replacement of the interfollicular structure by similar cells. Occasionally these cells were rather large and had lobate nuclei, resembling those of the Dorothy Reed giant cell.

The diagnosis of malignant lymphoma could hardly be questioned, but there was some doubt as to the proper subclassification. There were features of a reticulum cell sarcoma and of a malignant lymphoma of the lymphoblastic type. The impression was gained that the neoplastic state may have developed from an antecedent process of the giant follicular type.

Necropsy.—In addition to chronic, inactive rheumatic valvulitis, there was evidence of coronary arteriosclerosis. Sarcomatous infiltration was apparent in the left upper and left lower pulmonary lobes and in the bronchopulmonary, tracheobronchial, periesophageal, periportal, peripancreatic, mesenteric, and periaortic lymph nodes. The stomach, liver, and spleen were similarly affected.

A section of the spleen included a part of a nodule of neoplastic tissue surrounded by compressed, but otherwise normal, splenic tissue. The tumor was composed principally of small individual cells which closely resembled immature reticulum cells. These cells formed small spaces which resembed sinuses lying within a reticular framework. The uniformity of cell type was not consistent in all microscopic fields. At times, especially where there was active fibrous replacement, large, solitary, darkly stained neoplastic cells resembling the Dorothy Reed type of giant cell were conspicuous. The replacement by fibrous tissue was well advanced in some areas. Though a diagnosis of reticulum cell sarcoma was most satisfactory in this case, there were many microscopic features indistinguishable from those encountered in classic Hodgkin's disease.

Comment.—This case typifies the lack of a sharp division of classification in the realm of malignant lymphomas. There were microscopic features common to reticulum cell sarcoma, lymphoblastic sarcoma, and Hodgkin's disease. Considerable variation of opinion existed among the pathologists who reviewed the sections. This would tend to support the belief that these tumors are essentially of common origin.[3]

One particularly interesting feature was the similarity of necropsy findings in this patient and in Case 4. In both instances there was extensive fibrous replacement of lymphoid tissues, and often there were associated hyaline degenerative changes. These probably resulted from the therapy employed in the treatment of what must surely be regarded as a systemic disease affecting the lymphoid structures of the entire body. However, similar changes often occur in the spontaneous regression and fibrosis of neoplastic tissue in lymphomatous diseases.

CASE 9.—Mrs. M. S., a 35-year-old housewife, had complained of postnasal discharge for seven months, beginning in December, 1947. She was told that she had chronic sinusitis and was given eight roentgen treatments. In April, 1948, she became aware of a lump in her throat on the right side and a feeling of fullness and pain in her right ear. She was told that this was lymphoid tissue and that it would disappear. There had been a weight loss of 13 lb. (5.9 kg.) in seven months.

In July, 1948, the patient was asthenic and weighed but 91 lb. (41.3 kg.). There was a mass measuring 1 by 2 cm. along the right lateral pharyngeal wall, with forward displacement of the soft palate. The tonsils were surgically absent. Biopsy of this mass was reported as being indicative of reticulum cell sarcoma of the nasopharynx. A chest roentgenogram was normal. The serological test was negative, and there were no cervical, inguinal, or abdominal enlargements. The mass disappeared entirely after roentgen therapy to the pharynx.

The patient was readmitted to the hospital in October, 1948, because of dysphagia, excessive salivation, and hoarseness. A chest film revealed a pneumonic process in the right upper pulmonary lobe. A severe anemia was present, and blood transfusions were given, with resulting improvement in the blood picture.

Shortly thereafter the patient developed abdominal pain, localized in the region of the right ovary. This lasted until December, 1948, when left abdominal pain appeared. There had been continued weight loss, abdominal distension, and constipation. The pharynx appeared normal. There was the usual postirradiation atrophy of the skin of the cervical region. The liver was palpable 2 cm. below the costal margin. There was a firm mass in the region of the right ovary, with displacement of the uterus to the left. There were nodules in the left ovarian area and in the cul-de-sac. The stomach, chest, and colon were reported as normal on roentgenographic examination. The blood cell count was characterized by a normal differential count, with a slight anemia.

Exploratory laparotomy was followed by bilateral salpingo-oophorectomy and total hysterectomy. Bilateral ovarian tumors were found, which bore histologic relation to the original pharyngeal lesion. The Fallopian tubes were also involved, but not the uterus. A nodule was discovered over the medial aspect of the right kidney.

The patient reentered the hospital in March, 1949, with nodules near the left lobe of the thyroid, below the left clavicle, and over the right kidney. Emaciation was extreme, the patient weighing 76 lb. (34.5 kg.). Nitrogen mustard (3 mg. in 500 cc. of isotonic saline) was administered.

In April, 1949, she was readmitted to the hospital because of intractable pain in the right groin and right leg. Subarachnoid alcohol injection between the second and third lumbar vertebrae relieved her pain temporarily, but she required increasing doses of narcotics. A prefrontal lobotomy was performed, with excellent results. The patient returned to her home but died shortly thereafter, approximately 21 months after the onset of symptoms and 14 months after the diagnosis had been established. Permission for necropsy was not obtained.

Microscopic Study.—The original small pieces of tissue were composed principally of pharyngeal mucosa, skeletal muscle, and neoplastic tissue. The epithelium had been destroyed and the defect covered by a fibrinopurulent exudate, which overlay neoplastic tissue. The cells of the neoplasm were small and pleomorphic, with a regular tendency to form a network through a continuity of cellular processes, which seemed to enclose small clear spaces. Intercellular material, except for a delicate reticulum, was inconspicuous. Mitotic figures, often atypical, were numerous. The neoplastic cells had invaded the submucosal tissues and skeletal muscle in an unrestricted manner. No lymphoid tissue was included in the sections. This was a reticulum cell sarcoma.

Microscopic examination of ovarian tissue showed a diffuse invasion of the ovarian stroma with neoplastic cells. The cells were small and individual, with a tendency to occur in nests. They had short cytoplasmic processes, which gave a stellate appearance to many of them. They were associated with a delicate reticulum, but there was no significant formation of intercellular material. Despite the numerous mitotic figures, there were very few bizarre cells.

A definite diagnosis of the exact type of tumor was difficult to make because of the well-known vagaries of primary and metastatic tumors in the ovary. The cytology was quite consistent, however, with a diagnosis of reticulum cell sarcoma.

Comment.—In this patient, unlike Case 8, there was no symptom-free interval following recognition and treatment of the original lesion in the pharynx. This would seem to indicate that the pharyngeal tumor, as in Cases 4 and 6, was but an incidental, though recognizable, manifestation of an already disseminated lymphoid disorder. But, as indicated by Gall and Mallory, whether dissemination is the result of direct extension, metastasis, or independent foci of multicentric origin cannot be stated with any degree of certainty.[3]

The cytological characteristics of the tissues were similar to those of Case 8 but represented a more anaplastic type of growth, a factor which probably explains the slight variation in the clinical course of the two persons.

CASE 10.—E. W., a 40-year-old salesman, developed a sore throat on the right side in October, 1951. He was examined by two physicians, who gave him penicillin injections, without benefit. He was admitted to the hospital in February, 1952. Examination failed to reveal any generalized lymphadenopathy or liver and splenic enlargement. The Kahn test was negative, and the blood cell count was normal in all respects.

The right tonsil was enlarged and lobulated, with considerable hyperemia of the anterior pillar. On the right lateral pharyngeal wall there was a firm, smooth swelling which displaced the tonsil anteriorly. The mass extended inferiorly to involve the vallecula, thus causing curling and edema of the right half of the epiglottis. The larynx was not well visualized. There were no palpable cervical nodes. Biopsy of the pharynx was reported to reveal malignant lymphoma. Irradiation therapy resulted in complete regression of the pharyngeal mass. Six months later, in October, 1952, the tonsil was atrophic, the entire pharynx appeared normal, and the larynx could be well visualized.

Shortly thereafter the patient was admitted to another hospital, with symptoms and signs of intestinal obstruction. His physician conferred with one of us and was informed of the possible relation to the original illness. An exploratory laparotomy was done, and a large tumor mass involving the ileum was resected. There was a diffuse retroperitoneal nodular mass, comparable

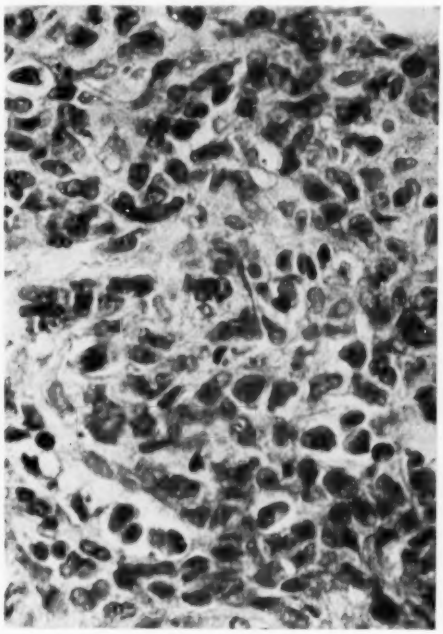

Fig. 9 (Case 10).—Biopsy section of pharynx, showing atypical reticulum cells with abnormal arrangement. Reticulum cell sarcoma.

to that found in the ileum. Biopsy of the resected tumor disclosed reticulum cell sarcoma. Roentgen therapy was given to the abdomen, and on April 1, the patient was reported to be free of symptoms, 5 months after his abdominal operation and 18 months after his original symptoms were noted.

Microscopic Study.—The biopsy specimen from the pharynx showed essentially the principal type of tissue to be composed of large, atypical polymorphous cells. Some were elongated; others were spherical with multiple attenuated cytoplasmic projections, while still others were spherical (Fig. 9). None resembled normal cells of any type. Mitotic figures were very numerous, and atypical mitoses were common. The cells assumed no special arrangement but were distinct from one another, often being separated by a loose interstitial delicate reticular framework. Superficially these masses of viable neoplastic cells became fused in a broad necrotic zone, in which polymorphonuclear cells and fibrin were conspicuous. Another type of tissue was essentially lymphoid in character. Though no lymphoid follicles were present in it, it had no definitive

neoplastic characteristics except where its structure merged with the invading intermediate masses of neoplastic cells. This tumor was interpreted as a highly undifferentiated reticulum cell sarcoma arising in lymphoid tissue of the pharynx.

A section of the wall of the ileum, including a Peyer's patch, revealed a neoplastic process similar to that found in a biopsy of the pharynx. A part of the Peyer's patch showed normal lymphoid follicles and lymphoid tissue covered by an intact normal mucosa. There was a gradual transition between this apparently normal lymphoid tissue and a diffuse neoplastic tissue which was superficially ulcerated and which permeated all layers of the wall of the ileum (Fig. 10). The neoplastic cells were about the same size as large monocytes, but they tended to be somewhat elongated. They occurred in groups but showed no tendency to adhere to one another or to form any consistent patterns of structure. Mitotic figures were numerous, with many bizarre and atypical forms. The type of cell, the character of the infiltration throughout the wall of the ileum, the mucosal ulceration, and the adjacent normal lymphoid tissue of the Peyer's patch were features which closely resembled those encountered in the biopsy of the pharynx. A diagnosis of reticulum cell sarcoma seemed to be the only one to be seriously considered.

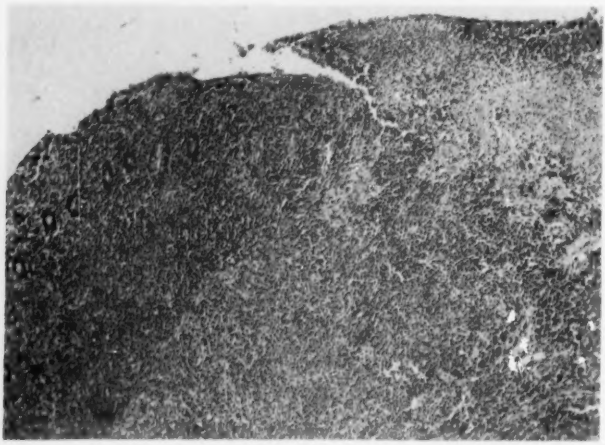

Fig. 10 (Case 10).—Section of wall of ileum removed at operation for intestinal obstruction. Note mucosal ulceration to the right and invasion of the entire wall by a diffuse neoplastic process histologically identical to that of the pharynx (Fig. 8). Reticulum cell sarcoma involving the ileum.

Comment.—This patient's clinical course has been that of a highly malignant lymphoma of the reticulum cell type, with an extremely poor prognosis. In fact, one is able to observe a fairly consistent pattern in the histories of this and the preceding three patients (Cases 7, 8, and 9). Similarly, the histopathological features in these four cases were fairly closely related, with allowances for varying degrees of anaplasia. The tumors in Cases 9 and 10 seemed to be the most anaplastic, and the sequence of events has substantiated this observation.

DIFFERENTIAL DIAGNOSIS

The finding of any abnormal or recurrent mass of lymphoid tissue in the nasopharynx, of a smooth unilateral swelling of the lateral pharyngeal wall, or of a unilateral tonsillar hypertrophy, with or without ulceration, should arouse suspicion as to the possibility of lymphoma.

One should consider first the various inflammatory disorders affecting these regions, bearing in mind that the distinction between inflammatory lymphoid hyperplasia and actual neoplasm may occasionally be difficult to ascertain. Tuberculous retropharyngeal abscess arising from chronic tuberculosis of the cervical vertebrae may resemble lymphoma of the pharynx, but the diagnosis should be apparent from roentgenograms. Tuberculosis of the nasopharynx, pharynx, or tonsillar region is seldom, if ever, seen independently of pulmonary tuberculosis. Acute inflammatory diseases, such as pharyngomaxillary space infections and infections causing ulceration and exudation, can usually be eliminated on the basis of cultures and other laboratory data.

Various tumors arising in these areas may resemble lymphomas in their clinical appearance. Among these are the mixed tumors of salivary type developing in mucous glands of the pharyngeal and palatal mucosa, adenocarcinomas of similar origin, and lymphoepitheliomas. The last-mentioned type is composed of mixed epithelial and lymphoid elements and probably represents a form of transitional cell carcinoma. Not infrequently a painless firm cervical adenopathy may be the first and only symptom of this type of tumor.

Neurofibroma (neurilemmoma, schwannoma) of the cranial nerves, particularly the vagus, may produce a smooth tumor mass in the lateral pharyngeal wall, resembling lymphoma. Chordomas and carotid body tumors, though rare, must be kept in mind.

The greatest problems in diagnosis arise in attempts to differentiate the lymphoid diseases themselves. The blood picture is nonspecific in patients with lymphoma, although as the disease advances, anemia invariably becomes evident. As Craver has pointed out, there are no clinical features which, without exception, will permit differentiation of tuberculous lymphadenitis, Hodgkin's disease, lymphosarcoma, aleukemic lymphatic leukemia, lymphoepithelioma, and even undifferentiated metastatic carcinoma in lymph nodes. To this group might be added the plasmocytomas, which may be either single or multiple and are occasionally found in the areas under consideration.[5]

Thus, one must rely almost entirely upon biopsy of the local tumor mass. If possible, a cervical lymph node should be removed for study at the same time.

Once the tissue is available, the various interpretations become a matter of importance and concern. We have noted how varying components of the lymphoid series may be simultaneously present in a given case or may make their appearance at different stages of the disease. Final judgment must, therefore, ultimately be placed upon continued study of the histopathological material and correlation of the resulting data with clinical manifestations.

SUMMARY AND CONCLUSIONS

The clinical and pathological data on 10 patients with lymphomas of the pharynx are presented.

In each patient the presenting symptoms were referable to the pharynx or nasopharynx, and there was initially no simultaneous evidence of systemic involvement or of disease elsewhere in the body.

The series included one patient with giant follicle lymphoma, two patients with malignant lymphoma of the lymphoblastic type, two patients with malignant

lymphoma of the lymphocytic type, one patient with malignant lymphoma of the Hodgkin's type, and four patients with malignant lymphoma of the reticulum cell type.

There was often a lack of sharp differentiation in the histologic classification of lymphomatous tumors. Microscopic features common to more than one type of malignant lymphoma were often evident in a given case. This would tend to support the concept that these tumors may have a common origin.

It was extremely difficult to predict the dissemination of a lymphomatous process to other parts of the body on the basis of the histologic picture.

There was evidence to support the recognized contention that malignant lymphoma may be of unicentric or multicentric origin.

The measures employed in the control of a generalized lymphomatous dissemination were effective in certain cases, but apparently resulted in extensive tissue alterations which were ultimately responsible for a fatal termination.

There were no clinical features which alone permitted differentiation of the various forms of malignant lymphoma.

Continued study of histopathological material and correlation with clinical data must form the basis for final evaluation of the disease in patients with nasopharyngeal or pharyngeal lymphomas.

ADDENDUM.—Since the preparation of this manuscript, two additional similar cases have been studied. One could be classified as a case of reticulum cell sarcoma of the tonsil; the other, as a case of the lymphoblastic type of lymphoma involving the nasopharynx and cervical lymph nodes.

122 S. Michigan Ave. (3).

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PHOTOGRAPHY IN RHINOPLASTY

An Office Technique

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BLACK-AND-WHITE photography is essential for rhinoplastic analysis and diagnosis and provides the requisite medicolegal and clinical records. Rhinoplastic photography must conform to the rigid standards of size and posing which have become accepted through custom and usage. These photographs must be uniform, of good quality, and faithful to the details of the facial features of the patient.

In cities in which there are medical photographers who specialize in rhinoplastic photography, the rhinoplastic surgeon should utilize their services. Their prices are usually moderate and are borne by the patient, as with other laboratory procedures. The use of studio portrait photographers, in cities in which such photographers are not available, is generally unsatisfactory. Their prices are relatively high, and it is difficult for them to produce pictures which are neither flattering nor complimentary. They utilize a diffusion light system in enlarging to obtain a soft effect and to minimize defects in the negatives. In the process of enlarging prints for rhinoplasty, a condenser light system is preferable, to provide more detail, sharp definition, and crisp contrast.

The rhinoplastic surgeon who has his own photographic equipment can, with the assistance of a commercial photofinisher, obtain rhinoplastic photographs comparable to those taken by medical photographers. Moreover, he can then take other pictures in his office for teaching purposes or to supplement his records. He might wish to photograph cases of caudal dislocation of the septum, columellar broadening, or other interesting abnormalities, but not at the patient's expense. I have found, however, that color photography is superior to black-and-white photography for this latter purpose.

When projection slides are desired for lecture and teaching purposes, color photography utilizing Eastman Kodachrome transparencies is much less expensive than black-and-white photography. It is an easier form of photography, because the finishing is done by Eastman Kodak, eliminating the dependence on a commercial photofinisher. These considerations might make it advantageous for the rhinoplastic surgeon who has satisfactory facilities for black-and-white photography in his own locality to maintain an office unit for color photography only.

Based on a lecture presented by the author at the Postgraduate Course in Rhinoplasty, Reconstructive Surgery of the Nasal Septum, and Otoplasty, given by Irving B. Goldman, M.D., at the Mount Sinai Hospital, New York, in affiliation with Columbia University, July 19, 1954.

BLACK-AND-WHITE PHOTOGRAPHY

Equipment.—Photographic equipment may be chosen for use outside the office, as well as for use in rhinoplastic photography. If cameras which lend themselves to home or vacation photography are selected, the physician beginning rhinoplasty will be less reluctant to undertake the necessary expense. The twin-lens reflex camera which yields twelve 2¼ by 2¼ in. negatives on each roll of 120 or 620 film is ideal as a general camera for black-and-white photography. The twin-lens reflex camera is easy to operate, and its ground-glass viewing screen facilitates composing and focusing. With only 12 negatives to a roll of film, this camera lends itself to quick film processing, with minimal or no loss of unexposed portions of film.

With 35 mm. film, a 20-exposure roll is the shortest roll available commercially. When a patient has presurgical photography, it is essential to get the finished prints as soon as possible. The use of a film length requiring that four patients be photographed to finish the roll is therefore not practical.

There are many good twin-lens reflex cameras, including the Rolleiflex, Rolleicord, Graflex 22, Zeiss Ikoflex, Dejur reflex, and Kodak reflex. The camera should have built-in synchronization for both flash bulb and electronic flash (MX synchronization). The choice of a camera depends essentially upon how much one wants to invest. As long as the lens is of good quality and the shutter speeds are adequate for general use, the less expensive camera may differ from the high-priced models only in respect to certain mechanical devices which are convenient but not necessary. The inclusion of a double-exposure prevention device is, however, well worth while.

Lighting.—One may use photo-floods, flash bulbs, or electronic flash (variously referred to as speedlight, repeating flash, and strobe). Photo-floods are inexpensive but uncomfortably warm for the patient. Flash bulbs are also inexpensive and eliminate the factor of heat. However, they are not convenient when taking a series of pictures because of the necessity of changing the bulb after each exposure. The electronic flash is a very simple method of lighting, and has excellent patient reception because the flash is so fast that it does not bother the eyes.

If photo-floods are used, one No. 2 photo-flood may be placed at each side of the camera at, or a little above, the level of the lens for the frontal and lateral views. It is advisable to use another No. 2 photo-flood just below or just above the lens for the basal view. When either conventional or electronic flash is used, the flash unit should be held just above the camera lens for the basal and the frontal views. For the lateral views, it should be held about 12 in. (30 cm.) from the lens on the same side as the patient is facing. With the light emanating from this direction, the profile is rendered sharp. With either type of flash, it is necessary to have a modeling light to provide illumination for focusing and for centering the portrait. For this purpose, I use the same light that I use for my head mirror.

With photo-floods, proper settings for shutter speed and lens opening (*f*/number) are obtained by consulting a table provided by the lamp manufacturers or by using a light meter. Once the proper exposure is achieved, this may be followed without further computation as long as the distance between the light source and the patient

is not changed. In general, when there is a choice, use as fast a speed (1/50 to 1/100 second) and as small a lens opening as possible. This prevents motion on the film and provides a greater depth of focus.

With flash bulbs, the exposure is determined by dividing the guide number by the distance in feet between the flash gun and the subject in order to get the *f*/number, or lens opening. The guide numbers vary with the shutter speed and the film speed, and a table indicating the proper guide numbers is printed on each flash bulb carton. In general, 1/100 second is a good speed to use with flash bulbs, as it stops any movement of the subject.

With electronic flash, the duration of the flash is constant and independent of the shutter speed. One therefore divides the guide number by the distance between the flash and the subject in order to get the lens opening, or *f*/number. It is advisable to use a relatively fast shutter setting (1/100 second) in order to eliminate extraneous light from sources other than the flash. The duration of the electronic flash varies between 1/500 and 1/5000 second, a speed which stops any motion.

It is difficult to be too definite about these details, as so much depends on the equipment used. The photographic supply dealer can usually supply this technical information, or it can be derived from the directions supplied with the equipment. To give an example, with my equipment (Rolleicord III camera, with Schneider Xenar *f*/3.5 lens and Powell repeater flash unit), I use these settings: lens opening of *f*/16, shutter speed of 1/100 second, at 3 ft. (90 cm.), with plus X film. It is helpful when beginning photography with new equipment to run a test roll of film, using first the recommended calculated exposures and then varying these settings. Comparison of these results will give a practical solution to the determination of the proper exposure.

Tripod.—The use of an elevator tripod is advantageous, as it enables an easy vertical shift of position. With a regular tripod, it is necessary to adjust all three legs each time the height of the camera is changed. If the floor is uneven, the modified microphone stand utilized by the Atco Company for a camera stand is helpful, since the relatively small, but heavy, base encompasses a smaller area of the floor.

A spirit level is useful to insure that the camera is level at all times. The plane of the patient's head and the plane of the film must be parallel in order to avoid distortion. Unless the camera is level, it is useless to pose the patient's head properly. It is necessary to take readings with the level in two directions: side to side and front to back. With the twin-lens reflex camera, there are usually sufficient flat surfaces upon which to rest a small level, and it is therefore possible to level the camera speedily and without difficulty at the beginning of each session. It is also possible to obtain a round spirit level with cross lines, which allows for leveling in all directions at once. This type of level is found in many old cameras.

Lens.—A supplementary close-up lens is not used in this work, as it causes distortion if the object being photographed, such as a head, has any depth. I use the normal lens, and I have the head, which occupies only a small portion of the negative, enlarged to the desired size when it is printed. A professional photographer eliminates distortion by using a special lens with a long focal length. This would be

a 135 mm. lens for a 35 mm. camera or a 9 to 10 in. (22 to 25 cm.) lens for a 5 by 7 in. view camera. With a long-focus lens, the camera must be farther away from the patient, but this takes additional room space.

Practically speaking, in rhinoplastic photography, the same result can be obtained with the normal lens of the twin-lens reflex camera by using a focusing distance several inches greater than the nearest focusing distance of the camera. I take my pictures with the patient 36 in. (90 cm.) from the camera lens, and I keep this distance constant with a measuring guide. I use a metal rod with a curved end, made from a curtain rod. This is set at 36 in. and is attached by a cord to the tripod. With this guide, I can quickly set the camera at the desired distance from the presenting portion of the patient's face. With this distance constant, the image size to object size relationship is constant. This helps the photofinisher by making it unnecessary for him repeatedly to readjust his enlarger while printing the different views.

Scale.—All pictures for rhinoplasty are printed half life-size, with the exception of the basal view, which is printed full life-size. The professional photographer obtains these proportions by the proper adjustment of his camera bellows. The same result may be accomplished by making two marks, 1 in. (2.5 cm.) apart, on the patient's chin and on each side of the face. For the latter, one mark should be made near the tragus and the other 1 in. from the first mark, along the Frankfort horizontal line. This achieves the double purpose of providing the scale and indicating the location of the Frankfort horizontal line. This line is an important guide in posing the patient, and later in the rhinoplastic analysis.

No ruler or other flat object should be used to make these marks, because the facial surfaces are never flat. A student's compass may be used to indicate the areas on the skin, and marks may then be placed at these sites with a pen. The easiest method is to use a "railroad pen," which may be purchased in a draftsmen's supply store. The pen has two points, which can be set at variable distances apart. For this purpose, the pen points are fixed at 1 in. apart, and the scale may then be established rapidly on the skin. I prefer ordinary blue-black washable ink, because, unlike heavier, permanent inks, it lends itself to making a fine dot or line and may be removed easily from the patient's skin.

The technique for using the scale is as follows: If the negative is enlarged so that the two marks are 1 in. apart on the finished print, the print will be life-size; if the two marks are ½ in. (1 cm.) apart, the print will be half life-size.

It is also possible to obtain half and full life-size pictures without the use of marks on the patient's face. The camera lens-to-patient distance is kept constant by the use of a measuring guide. With the help of the scale, the photofinisher can first ascertain the requisite settings of his enlarger for both half life-size and full life-size enlargements. Thereafter, as long as there is no change in technique, and the photofinisher uses the same enlarger, the pictures will be the desired size.

Chair.—The patient should be seated in a chair with a head rest. The whole chair may be rotated for the various views, or the patient may be turned without moving the chair. The latter method is advantageous, because the head rest is then behind the side of the patient's head for the lateral views and therefore does not show in the picture.

Background.—A black background should be used for black-and-white photography. It should be about 3 ft. (90 cm.) square and may be either permanently fixed on the wall or removable. It is generally advantageous to have the background from 1 to 2 ft. (2.5 to 5 cm.) behind the patient, because this intensifies the blackness of the background in printing. When children are photographed, it may be necessary for a nurse or an assistant to help hold the child's head motionless. Any hand used for this purpose should be encased in black cloth like that of the background. This hand, coming from behind the patient, will therefore show very little, if at all, in the finished picture. The material used for the background should not be shiny. The reverse side of a velvet or velveteen material produces a satisfactory background.

Views.—A routine set of rhinoplastic pictures comprises five views: a frontal view, a basal view, and three lateral views, consisting of a right profile, a left profile, and a right smiling profile.

Posing.—Careful posing is important, as faults in position will show up as faults in the picture. Uniformity in posing is necessary in order satisfactorily to compare "before" and "after" views. This eliminates the possibility that an apparent change in the appearance of the nose in the postoperative view might be the result of faulty posing rather than the surgical procedure. If the head is tilted, the print will show distortion. Unless the camera is level and the head properly posed, one cannot conclude that an abnormality seen in the picture is actually present.

Occasionally, because of an asymmetry of the eyebrows or the ears, it is not possible to use these areas as guides for proper positioning of the head. Posing patients is not as difficult as it may sound, however, and comes rather easily with practice.

Guides in Posing.—The following are guides to use while posing patients for lateral, frontal, and basal views:

A. Lateral view

1. Be certain that this is a true profile. It is helpful to turn the patient's head toward the camera lens until the eyebrow on the further side just begins to come into camera view, and then move the head slightly back.
2. The Frankfort horizontal line should be parallel to the floor. Beware of the patient's tendency to elevate his chin.
3. Avoid tilting. Turn the patient's body, not just his head, and have the head rest well forward.

B. Frontal view

1. Be certain that this is a true frontal view. One should see the same amount of each ear.
2. The Frankfort horizontal line should be parallel to the floor.
3. The eyebrows must be level.

C. Basal view

1. The head must be far enough back, with very little of the forehead visible on the camera viewing screen, to obtain a true basal view of the nose.
2. The ears must be on a level, and one should see the same amount of each ear.

3. Keep the eyebrows level.
4. The eyes must be closed. (The eyes are open in all other views.)
5. A modification of the basal view is possible with the use of Cellophane tape. The head should not be as far back as in the true basal view. The Cellophane tape is secured at the tip of the nose and brought up to the forehead. This raises the tip of the nose and makes it possible to show more of the interior of the nasal vestibules. This is useful in photographing deformities involving the caudal portion of the septum.

Printing.—In black-and-white photography, it is necessary to obtain a satisfactory working arrangement with a commercial photofinisher. If one can be found who specializes in medical work, he will also be able to render additional services, such as making projection slides from prints for lecture purposes. Otherwise, one should utilize the services of photofinishers who do developing and printing for free-lance photographers, and who may be found in any of the larger cities. An arrangement may be made whereby the exposed roll of film is mailed to the photofinisher and the finished prints are returned within one week. These photofinishers do custom work and should not be confused with the average photofinisher, who does printing for drugstores and camera stores. The latter do automatic machine printing, rather than the exacting custom printing needed for rhinoplastic photofinishing.

The photofinisher must be given a list of specifications, in order to obtain uniformity in printing. The size of the borders should be constant. The borders at each side and at the top should be narrow (¼ to ½ in.), and the border at the bottom should be wider (1 to 1½ in.) in order to provide space for noting the nasolabial angle and the projection angle. The distance between the nose and the border on the lateral views should be between ¾ and 1 in., in order that attention may be centered on the nose. It is customary to print these pictures on 5 by 7 in. paper.

COLOR PHOTOGRAPHY

Color photography is less exacting than the above-described technique for black-and-white rhinoplastic photography. It does not require the use of a scale, as the resulting transparency is viewed either through a table viewer or by projection on a screen. The photofinishing presents no problem, as the film is sent to Eastman Kodak for processing into a transparency.

For this work, the single-lens reflex camera, such as the Practica FX, the Exa, or the Exakta, is the most suitable. This utilizes 35 mm. film with a 20-exposure roll; this is satisfactory because time is seldom an important factor in this type of photography. As a rule, color photography is used to record interesting nasal deformities when a routine set of black-and-white views is not required, or to obtain transparencies for use in teaching and lecturing. After the initial equipment has been obtained, it is less expensive to make color transparencies for lecture work than to convert black-and-white prints into projection slides.

One present disadvantage in the use of color transparencies, as opposed to making projection slides, has been the difficulty in showing "before" and "after" views side by side. This problem is being overcome and will be reported at a later date.

In color photography, I use a more automatic method of photography than in black-and-white photography. Lighting and exposure are standardized, and the use of a measuring guide provides automatic focusing. One has only to follow directions to get good results.

Several units are available which are particularly useful in medical photography. Although none has been specifically intended for the rhinoplastic surgeon, the Atco unit, devised by Mr. Alvin Taylor for orthodontists, is extremely useful, as the photographic requirements of both fields are very similar. The measuring guide of this unit is an aid not only for automatic focusing but also for proper posing. With the close-up measuring guide and with the addition of extension tubes to the single-lens reflex camera, this unit can be used to take close-up views of the nose and to copy illustrations, pictures, or other inanimate objects. Other automatic units include the Mayfair Medicolite, the Walden Quick-Clix, and the Walco unit.

A pastel background, preferably light green, is advisable in color photography. To obtain good color rendition of the background and at the same time to avoid shadows, the background should be illuminated with an accessory light source.

Color film is available in either tungsten (Type A) or the daylight type. It is necessary to use the correct combination of color film and lighting. Tungsten-type film should be used with photo-floods or ordinary flash bulbs. Daylight-type film is used with blue-coated flash bulbs or the electronic flash.

SUMMARY AND CONCLUSIONS

Good black-and-white photography is essential for rhinoplastic analysis and diagnosis. The technique of posing, lighting, and printing must be standardized and capable of being repeated without change, in order to obtain an acceptable comparison between preoperative and postoperative pictures. The "before" and "after" sets of pictures must have objectivity if they are to have value. Unless a medical photographer specializing in rhinoplastic photography is available, the rhinoplastic surgeon should have his own office unit for black-and-white photography.

An office unit for color photography is useful to record interesting deformities not requiring routine rhinoplastic photography and to obtain projection slides for teaching and lecturing. The rhinoplastic surgeon with satisfactory facilities for black-and-white photography in his own locality may therefore desire to maintain an office unit for color photography only.

An office technique for both black-and-white and color photography which requires very little previous photographic experience is described. It enables the rhinologist to fulfill his own photographic needs. The only professional assistance required is that of a commerical photofinisher to print the black-and-white photographs.

14 Central Ave.

EXPERIMENTAL STUDY OF THE EFFICIENCY OF TWO GROUP HEARING TESTS

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INTRODUCTION

HEARING conservation programs in the public schools are the concern of both otologists and educators, to say nothing of parents. Tremendous progress has been made in recent years in medical treatment of conditions producing hearing loss, and educators have likewise progressed in providing for the special needs of children with hearing impairments of a permanent type. The heart of a hearing conservation program is the hearing testing survey, since special facilities for hard of hearing children are of little avail if such children remain undiscovered. Today, most school districts and counties are aware of their responsibilities for discovering cases of hearing impairment and have provided means and personnel for testing the hearing of their pupils. There is by no means universal agreement, however, as to the best method of conducting hearing testing surveys.

There are two principal methods in common use today of "screening" a school population for hearing losses. One method is to administer a group test—usually to 40 children simultaneously. The other method is to give each child an individual "sweep-frequency" test with a pure-tone audiometer. The advantage of the group test is that large numbers of children may be screened in a relatively short time. The advantage of the individual test is that, though time-consuming, it is at present the most accurate means we know of assessing a person's hearing.

There are two principal forms of the group hearing test in use at present. These are the Western Electric group phonograph speech audiometer, also known as the "fading-numbers test," and the Massachusetts hearing test, a pure-tone "sweep" test applied on a group basis. Of these two tests, the Western Electric is more commonly used, because it was the first group test devised for school testing, having been on the market for 30 years. Group pure-tone testing, on the other hand, is, in this country, a post World War II development.

The concern of otologists and educators with group hearing tests is that they perform with reasonable efficiency in discovering cases of hearing impairment. In this respect, the Western Electric fading-numbers test has received considerable criticism. Perhaps the most complete and devastating attack on the efficiency of

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this test was made by Ciocco and Palmer,[1] who compared the group test records of 5,000 school children with their individual pure-tone test results and found that the group test had failed to detect a considerable number of children with significant hearing impairments. In spite of such criticisms, however, the Western Electric test continues in wide usage in schools throughout the nation.

Various forms of group pure-tone tests have been proposed by Harris,[2] Reger and Newby,[3] Johnston,[4] and by others, as an answer to the inadequacy of the Western Electric test as a screening instrument. Of these group pure-tone tests, the only one which has come into any considerable use is the Massachusetts hearing test, developed by P. W. Johnston.

Proponents of group pure-tone testing argue that such a test is more efficient at detecting hearing loss in general, and high-frequency hearing loss in particular, and yet is no more difficult to administer than the fading-numbers test. The continued popularity of the Western Electric test is not surprising, however, in spite of arguments for the group pure-tone method, for otologists and public school educators are faced with some very practical questions, which are as yet unanswered: first, is the group pure-tone test more efficient than the phonograph test; second, if it is more efficient, is it sufficiently superior to justify the replacement of existing phonograph audiometric equipment?

To answer these questions, a research project in hearing testing of school children was designed in which the performance of the Western Electric group phonograph audiometer could be directly compared with the performance of the Massachusetts hearing test.

PROCEDURE

Arrangements were made through the Board of Education of a large city in California to perform an experiment in which the screening efficiency of the Western Electric 4CA group phonograph audiometer and the Massachusetts group pure-tone testing method could be directly compared. Both group tests were administered to a total of 1,496 children from kindergarten through sixth grade in four elementary schools. In addition, each child was given an individual pure-tone sweep test at the 15-db. level, and all who failed the sweep test were given individual pure-tone threshold tests. Any child exhibiting a hearing loss in either ear of 20 db. at two frequencies or 30 db. at one frequency was considered to have a "medically significant" hearing loss. One hundred nineteen (7.35%) of the 1,496 children tested were thus identified as having medically significant losses. The efficiency of the two group tests was determined by noting the accuracy with which each test singled out those with medically significant hearing losses and also the accuracy with which each test identified those with "normal" hearing.

The Massachusetts test and the individual tests were administered by one of us (K. O. J.), and the Western Electric test was administered by the regularly employed audiometrist of the school system. All children in the study received the group tests before being given the individual tests. The audiometrist conducting the individual tests had no knowledge of the performance of the subjects on the group tests. In three of the four schools involved in the study, all tests were completed in a period of two weeks; in the fourth school, a month was required to complete all tests.

Since it is generally accepted that pencil and paper forms of group hearing tests are not reliable at the lower grade levels, for purposes of analysis the data obtained from testing the third through sixth grade were separated from those obtained from tests performed in kindergarten through the second grade. Standard procedures in administration of the Western Electric test were followed in the third through sixth grade, while a modified form of the test was employed in kindergarten through the second grade. Standard procedures in administration of the Massachusetts test were followed in the second through the sixth grade, and a modified form of the test was employed in kindergarten and first grade.

In the Western Electric 4CA test, the test stimuli consist of two-digit numbers which "fade" from a level of 30 db. above the normal threshold to a level of —3 db. in successive 3-db. steps. The subjects hear four series of digits running the gamut of intensities indicated above. Two series are spoken by a male voice and two series by a female voice. The digits are recorded on a disc with four series on each side. Forty subjects at a time are tested monaurally through No. 716A earphones, while the audiometrist plays one side of the record on a phonograph. The subjects write the digits heard on a specially prepared test blank. The phones are then shifted by each subject to the opposite ear, and the audiometrist plays the other side of the record. According to the procedures followed in the present study, a child failed the 4CA test if he did not succeed in hearing in each ear two unbroken series of digits—one male series and one female series—to and including the 6-db. level. Children who failed the group test were given a second group test. Only those children who failed both administrations of the 4CA test were considered to have been screened out as "hard of hearing." This was the procedure followed in administering the test to the third through the sixth grade. The Western Electric test equipment used in this study belonged to the school system in which the testing was done.

With children from kindergarten through the second grade, a modified form of the 4CA test was administered. Instead of 40 children, as tested by the standard procedure, 10 of the younger children were tested simultaneously. Responses to the test stimuli were verbalized by the children instead of being written. The audiometrist observed the reactions of each child closely, and any child who apparently was having difficulty in repeating the digits heard through his earphone was required to respond by himself until the audiometrist was satisfied that the child either heard through the 6-db. level or did not. Those who did not respond correctly through the 6-db. level were considered to have failed the test.

The Massachusetts group pure-tone method consists of using a pure-tone audiometer as the source of test stimuli, and, like the Western Electric group test, delivers these stimuli to 40 earphones simultaneously. For purposes of this study, equipment loaned by the Maico Company was used: a model F-1 audiometer, 40 model RS phones, an adapter box, and connecting leads. Standard testing procedures as recommended by the Maico Company were employed in the administration of the test in second through sixth grade. Three test frequencies—500, 4000, and 8000 cps—were presented at fixed sensation levels of 20, 25, and 30 db., respectively. There were six trials at each frequency, during which the audiometrist either presented a spurt of tone at its fixed sensation level or did not present the tone. Subjects responded to the test by encircling either "yes" or "no" for each trial on their test paper, depending on whether or not they heard a spurt of tone following an alert signal given by the audiometrist. After completion of the first series of 18 trials, subjects placed the phone over the opposite ear and a second series of trials was presented. Papers were scored by the method recommended by the Maico Company, based on Johnston's method: the number of "no" responses were counted on each paper for each ear, and subjects whose "no" responses in either ear varied by more than two from the correct number were failed. Those who failed the group test were given a second group test, and those who failed the second test were considered to be screened out as being "hard of hearing." Of course, before any group testing was done, it was necessary first to calibrate the pure-tone audiometer with the 40 phones. This was done by having adult subjects match loudness of tones heard through one of the group phones with the loudness of the same tone heard through the single receiver of a calibrated audiometer. Thus, for example, in order to obtain the desired output in the group phones of 20 db. at 500 cps, it was found that the hearing loss dial of the audiometer had to be set at a reading of 65 db. In determining for which trials the test tone should be presented and for which trials no tone should be presented, the audiometrist followed a previously prepared master guide.

For kindergarten and first-grade children, the standard testing procedure described above was modified. Twenty children at a time were tested, and they responded to the stimuli presented by raising their hands if they heard. Throughout the testing, the children kept their eyes closed, so they would not be influenced by responses of their neighbors. By this method, it was possible for the audiometrist quickly to eliminate from his attention those children whose responses were accurate, and to concentrate on the children whose responses were uncertain. The children were motivated to cooperate in the test situation by identifying the 500-cycle tone with a bear, the 4000-cycle tone with a deer, and the 8000-cycle tone with a bird. Those children who did not respond correctly at the screening levels employed were considered to have failed the test.

All individual pure-tone tests were performed with the Maico F-1 audiometer, using standard audiometric techniques, both for the sweep test and for the follow-up threshold test. For the individual testing, a headset containing two matched F-1 receivers was employed, so it was not necessary to shift an earphone from one ear to the other. Subjects responded by raising their hands when they heard the stimulus. Frequencies presented in the individual tests were the even octaves from 125 through 8000 cps.

The results of the comparisons of the failures and passes on each group test with the failures and passes on the individual tests were subjected to statistical treatment, after which it was possible to make conclusions concerning the comparative efficiency of the group tests in screening out cases of medically significant hearing loss. The results of the individual pure-tone threshold tests were taken as the criterion by which the efficiency of the group tests was judged.

TABLE 1.—*Comparison of Group Tests with Individual Test Given in the Third Through Sixth Grade*

	Total Tested, No.	Passed Individual Test, No.	Passed Individual Test, %	Failed Individual Test, No.	Failed Individual Test, %	Failed Individual and Passed Group Test, %	Passed Individual and Passed Group Test, %	Failed Individual and Failed Group Test, %	Passed Individual and Failed Group Test, %	Tetrachoric Coefficient of Correlation
Individual Test	912	845	92.65	67	7.35	....	.....	....	....	....
Western Electric Group Test	...	...	.....	..	....	5.81	87.06	1.54	5.59	0.37
Massachusetts Group Test	...	...	.....	..	....	1.32	91.34	6.03	1.32	0.97

TABLE 2.—*Comparison of Group Tests with Individual Test Given in Kindergarten Through Second Grade*

	Total Tested, No.	Passed Individual Test, No.	Passed Individual Test, %	Failed Individual Test, No.	Failed Individual Test, %	Failed Individual and Passed Group Test, %	Passed Individual and Passed Group Test, %	Failed Individual and Failed Group Test, %	Passed Individual and Failed Group Test, %	Tetrachoric Coefficient of Correlation
Individual Test	584	532	91.10	52	8.90	....	.....	....	....	....
Western Electric Group Test	...	...	.....	..	....	7.02	90.07	1.88	1.03	0.72
Massachusetts Group Test	...	...	.....	..	....	2.74	89.21	6.16	1.88	0.93

RESULTS

The efficiency of any group screening test of hearing depends upon two factors: first, how well it succeeds in identifying subjects with hearing impairments, and, second, how well it identifies subjects with normal hearing. To operate with perfect efficiency, then, a group test must fail every subject whose hearing is defective and pass every subject who has normal hearing. No group test can be expected to perform with perfect efficiency. A measure of the efficiency with which it does operate, however, can be obtained from analyzing its performance with a large number of subjects whose classification as "hard of hearing" or "normal in hearing" has been determined by individual testing.

In Tables 1 and 2, the performance of the Western Electric 4CA and the Massachusetts form of group pure-tone test has been compared on the same subjects, all of whom had received individual tests. Table 1 summarizes the data obtained from

testing in the third through the sixth grade, while Table 2 gives a like summary for the testing in the lower grades. The data for the two age groups are presented separately, because ordinarily group testing with standard techniques is not attempted with children younger than third graders. As explained in the previous section, however, in this study the group tests were utilized, with certain modifications, as screening instruments with children as young as kindergarteners. Because of the modifications required in group testing in the lower grades, it was considered advisable to present separately the data obtained from the testing in kindergarten through the second grade.

An examination of Table 1 reveals that out of 912 children tested, 7.35% were determined, on the basis of the individual tests, to have "medically significant" hearing losses. If the group tests were operating with hypothetically "perfect" efficiency, 7.35% of the subjects should have failed the group tests, and 92.65% should have passed. Table 1 shows that 5.81% passed the Western Electric test when they should have failed and that 5.59% failed the Western Electric test when they should have passed. In other words, the Western Electric test misclassified 11.40% of the subjects tested. The tetrachoric coefficient of correlation between the Western Electric test and the individual tests was 0.37 (a correlation of 1.00 would indicate perfect agreement).

The Massachusetts test results agreed much more closely with the individual tests. Only 1.32% of the subjects in the higher grades passed the Massachusetts test when they should have failed, and only 1.32% failed the group test when they should have passed. The Massachusetts test thus misclassified 2.64% of the subjects. The tetrachoric coefficient of correlation between the Massachusetts test and the individual tests was 0.97. It can thus be seen that in this particular testing situation the Massachusetts test performed much more satisfactorily as a screening instrument than did the Western Electric 4CA test.

An examination of Table 2 reveals that with the younger children, the Massachusetts test was likewise more efficient in separating those with impaired hearing from those with normal hearing. The tetrachoric coefficient of correlation between the Western Electric test and the individual tests is considerably higher in Table 2 than in Table 1. This higher correlation is due to the fact that fewer of the young children failed the Western Electric test when they should have passed. The record of the Western Electric test is still quite poor in regard to the percentage of subjects passing the group test when they should have failed. In the lower grades 7.02% of the children should have failed the group test but were passed. In all, 8.05% of the younger subjects were misclassified by the Western Electric test.

With the younger subjects, the record of the Massachusetts test is about the same as it was with the older subjects; 2.74% passed the group test when they should have failed, and 1.88% failed the group test when they should have passed. A total of 4.62% were thus wrongly classified by the Massachusetts test. The agreement between the Massachusetts test and the individual tests is represented by the tetrachoric correlation coefficient of 0.93.

An examination of Tables 1 and 2 conveys the information that the Massachusetts test was obviously performing at a higher level of efficiency than was the Western Electric test. What is not revealed by Tables 1 and 2, however, is whether or not the differences in efficiency of the two group tests are statistically significant. Without presenting the details of the statistical analysis here, it should be reported

that statistically significant differences were found between the group tests in their ability to identify hard of hearing subjects in both age groups and in their ability to identify those with normal hearing in the higher grades. There was no significant difference between the tests in their ability to identify those with normal hearing in the younger grades.

COMMENT

The advantage of a group screening test of hearing is the time-saving factor. With the testing of 40 children simultaneously, and making allowance for group retests and unforeseen contingencies, it is possible to screen at least as many as 400 children a day. In contrast, the rate of screening children with an individually administered sweep frequency test is approximately 100 a day.[5] Thus, with group testing, it is possible to screen four times as many children with the same number of audiometrists.

The object of screen testing, however, whether it be done in groups or individually, is to discover cases of impaired hearing, so that proper medical and educational attention can be provided for those who need it. Unless a group test can successfully designate those persons who have impaired hearing, it is useless as a screening instrument. And since every child who fails the group test must be retested individually, the group test must also be capable of discriminating those with normal hearing; otherwise, so much time and energy will be devoted to needless retesting of normal ears that the time-saving advantage of the group test will be nullified. Any group test of hearing, therefore, must be evaluated in terms of, first, and most important, its ability to discover cases of actual hearing impairment, and, second, its ability to discriminate those with normal hearing.

In the context of the present study, the Western Electric 4CA group phonograph audiometer must be evaluated as an inefficient screening device. The most damning evidence against its efficiency is the fact that 5.81% of the older subjects passed the group test when they should have failed and 7.02% of the younger subjects passed the group test when they should have failed. In the older grades, 67 children failed the individual test. Only 14 of these 67 children failed the Western Electric test. In other words, 53, or 79%, of the hard of hearing children in this age group went undiscovered by the Western Electric test. A similar picture is presented when the performance of the Western Electric test with the younger children is examined. Forty-one of the 52 children with defective hearing passed the group test. Again the group test had failed to discover 79% of those with impaired hearing. A group test which discovers only one out of five hard of hearing children must be considered to be grossly inefficient.

In respect to its ability to discriminate normal ears, the Western Electric test was inefficient in the higher grades, wrongly failing 5.59% of the total ears tested. Thus 51 children were needlessly referred for individual tests. With the younger children, the Western Electric test identified normal ears with satisfactory accuracy.

In contrast to the performance of the Western Electric test in discovering impaired ears, the Massachusetts test was much more efficient. Of the 67 children in the older age group who should have failed the group test, only 12, or 18%, were wrongly passed by the Massachusetts test. In the lower grades, the Massachusetts test failed to discover 16 of the 52 children who had defective hearing, or, in other words, wrongly passed 31%. The Massachusetts test thus was successful in discovering 4 out of 5 hard of hearing children in the higher grades and 7 out of

10 hard of hearing children in the lower grades. In respect to the misclassifying of normal ears as impaired, the record of the Massachusetts test is satisfactory in both grade groups.

The most important question raised by this study is what standard of efficiency can reasonably be expected of any group screening test of hearing? The Massachusetts test in the present study missed one out of five children in the higher grades who, on the basis of their individual test results, had medically significant hearing losses. Is this an acceptable standard of performance, or should the Massachusetts test be judged as unacceptably inefficient?

The answers to these questions depend upon two primary considerations. First is the inescapable fact that no group test can be expected to discover 100% of the cases of hearing impairment in a large population of school children. There are bound to be a certain number of children with marginal losses or fluctuating losses who will just barely pass a hearing test one day and just as barely fail it the next day. Such children would demonstrate inconsistency on successive individual tests.

A second consideration is the relative importance to be attached to numbers of children screened and the accuracy of the screening method. If four times as many children can be screened with a group test as can be tested individually, perhaps it is more important to test more children with 90% accuracy than to test fewer children with 100% accuracy. Especially might this be true if one considers that a good many of the hypacusics misclassified by the group test as normal are those with marginal losses, who might also have passed a second individual test.

In the light of these considerations, it is our feeling that in the present study the Massachusetts test performed with acceptable efficiency, at least in the third through the sixth grade level. And when one considers the difficulty in obtaining accurate hearing tests by any means of children in the lower grade levels, perhaps the record of the Massachusetts test in discovering 7 out of 10 hard of hearing children in the kindergarten through the second grade level is also acceptable efficiency. We believe, however, that with the younger children the success of the group testing technique depends so much on the audiometrist's skill in observation of the subjects' behavior, that it would be preferable as the general practice to spend the additional time needed to give each child an individual test.

Another question raised by this study is why did the Western Electric 4CA group phonograph audiometer perform so poorly as a screening instrument? We believe that the answer to this question is that the Western Electric test utilizes extremely simple speech stimuli. As many previous writers have pointed out, an alert youngster with considerable hearing loss in frequencies above 500 cps can still distinguish the digits of the Western Electric test by responding to the vowels alone. Many children who fail individual hearing tests do so because of losses in frequencies outside the so-called speech range. Such children would almost certainly pass the Western Electric test, since their losses do not affect their ability to hear speech. Yet, who is to say that losses at 4000 to 8000 cps are not medically significant? It seems evident, then, that in order to correlate highly with individual test results, a group test must be of the pure-tone, rather than the speech, variety.

A final question which arises from this study is how could the efficiency of the Massachusetts test be improved? First of all, one must consider the possibility that the performance of the Massachusetts test in this study might represent the maximum efficiency possible for any group test. As was stated above, no group test

can be expected to identify 100% of the children who would, on any one occasion, fail an individual test. We feel, however, that in the present study the Massachusetts test was operating at something less than maximum efficiency. We feel that the relatively few children with "normal" hearing who passed the group test is an indication that the failure criterion of the test may have been too lax. In other words, we believe that the test can well afford to fail more normal ears in order to reduce the percentage of impaired ears which are wrongly classified as normal. Standard procedure with the Massachusetts test calls for screening levels of 20 db. at 500 cps, 25 db. at 4000 cps, and 30 db. at 8000 cps. If these levels were reduced to 15, 20, and 25 db., respectively, we believe that more of the subjects with impaired hearing would have been discovered, without the failure of an unreasonable number of normal ears. While the particular frequencies employed in the Massachusetts test may be open to question, it is felt that the efficiency of the test would not have been markedly affected by testing at different or additional frequencies. However, it would certainly be worth while to experiment with the test in this regard.

SUMMARY AND CONCLUSIONS

This article presents the results of an experiment in comparing the performance of two group hearing tests conducted in the public schools of a large city in California. One thousand four hundred ninety-six elementary school children were tested with the Western Electric 4CA group phonograph speech audiometer and by the Massachusetts group pure-tone test method. In addition, each child was given an individual pure-tone sweep frequency test, and each child who failed to hear any frequency at the 15-db. level was given an individual threshold test. Children whose losses in either ear were 20 db. at two frequencies or 30 db. at one frequency were considered to have medically significant losses. The performances of the children on the individual test were the criterion against which the efficiency of the group test was judged.

The Massachusetts test was shown to be significantly superior in efficiency to the Western Electric test in discovering children with impaired hearing in both upper and lower grades and in discriminating children with normal hearing in the upper grades. The fading-numbers test failed to discover 4 out of 5 children with impaired hearing, while the Massachusetts test failed to discover only 1 out of 5 hard of hearing children in the upper grades and 3 out of 10 hard of hearing children in the lower grades.

The following conclusions are justified within the limitations of the present study:

1. The Massachusetts test was superior to the Western Electric test as a screening instrument.

2. The Western Electric test was grossly inefficient in discovering children with medically significant hearing losses.

3. The Massachusetts test performed at acceptable levels of efficiency, at least in the upper grades.

4. It may be possible to increase the efficiency of the Massachusetts test further by lowering the intensity of the screening levels presently employed.

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INTRATHORACIC RHABDOMYOSARCOMA

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RHABDOMYOSARCOMA is a tumor histologically characterized by the presence of the strap- and racquet-shaped cells, in which it is sometimes possible in good preparations to demonstrate cross striations and longitudinal myofibrils, and by giant cells with peripherally arranged vacuoles, causing the cell to resemble a spider or a spider's web. The cytoplasm of all these cells is more or less acidophilic. Grossly the tumors are found in or adjacent to striated muscles in various parts of the body, but most commonly in the thigh and leg.

Grossly, the tumor tissue varies greatly in its hardness because of the great variations in the amount of collagen in it. Generally it is rather soft, somewhat reddish, and may be mottled with various tints of red and cream from hemorrhage and necrosis. It is often circumscribed but always infiltrates surrounding tissues, although it is not always possible grossly to demonstrate this.

These tumors have been found in certain definite systems and regions of the body. These are more particularly the genitourinary system (bladder, kidney, prostate, testis, spermatic cord, uterus, vagina, round ligament, and ovary), the heart, the upper respiratory and alimentary tracts, and the orbit. Sporadic examples have been found in the lung, breast, esophagus, adrenal, and brain. The tumors have been found both in voluntary (striated) and in involuntary (nonstriated) muscles.

The tumors with which the rhabdomyosarcoma is most easily confused are liposarcomas and fibrosarcomas. The liposarcomas commonly form bizarre giant cells, but the nuclei are very apt to be pyknotic, and lipid droplets are always demonstrable in some part of the growth. The rhabdomyosarcoma is sometimes mistaken for a fibrosarcoma, because the cells are often elongated and connective tissue fibers are usually present between them, but the presence of bizarre giant cells removes the growth from the fibrosarcoma class.

According to Ewing,[2] rhabdomyosarcomas of voluntary muscles arise from adult tissues and form an important group of malignant tumors of the limbs and trunk. Embryonic disturbances are probably responsible for the occurrence of certain tumors of voluntary muscle, especially in infants and children, and some of these may arise from embryonal cells.

They appear as single or multiple, nodular or voluminous, flat or rounded, diffuse or circumscribed, and even polypoid growths. They are usually soft and grayish on section, and marking produced by muscle bundles alternates with abun-

dant connective tissue stroma. Very cellular forms are more opaque, yellowish, reddish, soft, and often diffuse. They have the appearance of teratomas.

The only well-recognized malignant tumor arising from voluntary muscle tissue is the rhabdomyosarcoma derived from muscle cells.

Two main types of structure may be recognized, anaplastic and adult. The cell cytoplasm is acidophile, the form spindle-shaped or elongated; longitudinal or cross striae are demonstrable. The nuclei are voluminous, with prominent nucleoli, and centrosomes and centrioles are notable.

The presence of giant cells and peculiar intracellular fibrils is essential and characteristic of this tumor.

Metastases to the lungs and liver and other organs usually occur, but seldom to lymph nodes. In the slow-growing tumors they may be long delayed. Well-encapsulated tumors have been cured by simple resection, but recurrence is the rule, followed by fungation, infection, and metastasis. Ewing also feels that most rhabdomyosarcomas have been found resistant to ordinary methods of external radiation and that interstitial radiation is required.

Review of the literature reveals that Weber in 1854 described a tumor of the tongue which was excised but later recurred; it was made up of striated muscle cells in all stages of differentiation, from adult to embryonal cells. This tumor could have been a rhabdomyosarcoma.

During the following years many studies of striated muscle tumors were published. These tumors have variable gross characteristics, rate of growth, and appearance; they affect both sexes and persons of all ages, from the newborn infant to the octogenarian; they grow at enormously variable rates of speed, and develop in animals as well as in man.

Jönsson [6] reported 39 cases of rhabdomyosarcoma of the peripheral voluntary muscles. The majority of these cases showed involvement of the thigh and leg muscles. These were studied by Olle Rauterwall.

Wolbach,[3] in 1928, described a rhabdomyosarcoma of the spinal muscles in a girl aged 4 years, which showed cross striations in the tumor cells.

Cappell and Montgomery [5] described two such polypoid rhabdomyosarcoma tumors of the palate. These apparently arose from palatal muscles.

J. Sverjda reported a rhabdomyosarcoma of the middle ear in a boy aged 5 years. This may have had its origin from the palatal muscles around the Eustachian tubes.

In 1929 Hirsch reported a tumor of the muscles of the leg in a child aged 7 years, and in 1931 a tumor of the neck in a man aged 21, which showed these typical pathological changes.

Stout [4] has apparently studied the largest and most interesting series, totaling 121, the thigh and leg being the common site. These cases showed that the tumors infiltrated insidiously and metastasis was through the blood and lymphatic channels, but the lungs were the most favored repository.

The youth of some of the cases reported raises the question whether the tumors arose from mature differentiated muscle fibers or from still immature embryonic myoblasts, a question all the more pertinent in view of doubtful and limited capacity of striated muscle for proliferation once it has attained adulthood.

The tumors which develop in heart muscle can be considered benign, and are highly specialized, relatively well-differentiated growths, which are considered congenital malformations by many, since they are frequently associated with tuberous sclerosis, kidney tumors, and cysts.

The treatment employed in most cases consisted of simple excision, amputation, and, to a less extent, radiotherapy. Stewart found that the few rhabdomyosarcomas treated by radiotherapy at the Memorial Hospital were resistant.

Commonly the only symptom is tumor, which in 88.5% developed without any history of antecedent trauma, and often without pain or interference with function. Increase in size is sometimes rapid and sometimes extremely slow; a considerable bulk may be obtained, although not as a rule the massive proportions of many liposarcomas. The deep situation and muscular involvement produce a moderately firm deep-seated mass, which is of very limited mobility. Sometimes growth of the tumor comprises the overlying skin, and the tumor fungates. This may happen after biopsy.

In reviewing the literature on the studies of rhabdomyosarcomas, I have found no mention of the tumor involving the intrathorax.

The muscles which complete the boundaries of the thorax are the diaphragm and intercostal muscles (external and internal), along with three series of smaller muscles, the triangularis sterni, the levatores costarum, and infracostales.

Mesothelioma is the commonest tumor of the pleural cavity.

I should like to report a case which came under my care in January, 1953, and which was diagnosed as intrathoracic rhabdomyosarcoma.

REPORT OF A CASE

History.—Mrs. M. D., aged 62, a white woman, was admitted to the Valley Hospital on Dec. 26, 1952, with a severe shortness of the breath of one week's duration. On May 19, 1944, she had a supravaginal hysterectomy, right salpingo-oophorectomy, appendectomy, and separation of pelvic adhesions, at the Woman's Hospital, New York. For the past 10 years she has been suffering from arthritis, with inability to walk during the last five years because of ankylosis of the knees. She has had generalized weakness, with a dry, hacking cough of one week's duration.

The temperature was 99.4 F., respirations 28, blood pressure 166/90. Physical examination revealed dullness of the right thorax with diminished breath sounds. There were rales of both lung bases and slight edema of the feet.

The urine was normal; hemoglobin 12.2 gm. per 100 cc.; RBC 4,530,000; WBC 7,290, with 87% polymorphonuclears. Sedimentation rate was 23 mm. in one hour; serum protein, 6.5 gm. per 100 cc., and blood nonprotein nitrogen, 30 mg. per 100 cc. Electrocardiogram was essentially normal. Chest taps failed to produce any fluid. One week after admission she had a coughing attack, which produced a great deal of mucus. No bloody sputum was ever noted.

X-rays of the chest taken on Dec. 29, 1952, showed the heart to be displaced somewhat to the left. There was a flat density over the right side, extending up to the level of the sixth rib posteriorly or the second rib anteriorly. The apex of the lung appeared clear. There was the appearance of a massive pleuritic effusion on the right side. The left lung appeared clear.

Reexamination of the chest on Dec. 30, 1952, showed no change in the appearance since the last examination. The fluid reported on the right side appeared to be encapsulated against the anterior wall.

Examination of the skull showed the tables to be well formed, with no evidence of fracture.

Bucky films of the chest on Dec. 31, 1952, showed evidence of a multiloculation in the lower two-thirds of the right pleural space. The diaphragm posteriorly was visualized on both sides and presented a normal contour. The overlying lung on the right side and the left lung appeared clear.

Reexamination of the chest on Jan. 5, 1953, showed the loculated density of the right side that was previously reported. One gets the impression that the tension was somewhat less than that originally seen.

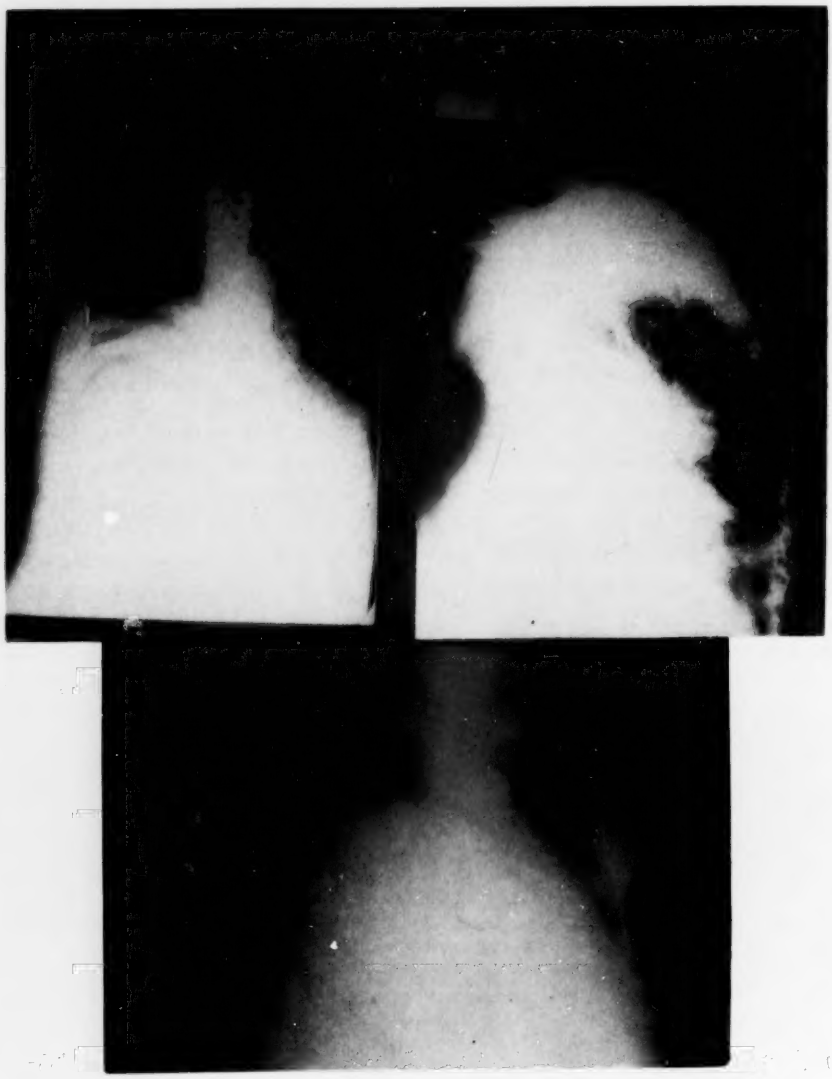

Fig. 1.—X-rays of chest.

A bronchoscopy, performed on Jan. 9, 1953, showed a normal larynx, trachea, and carina. The lumen of the left bronchus was normal, with some excessive mucus. The right bronchus showed a mucoid discharge, mucosal thickening, narrow lumen, and considerable pus exuding from the right middle orifice. No ulcerations or growths were noted. Because of the marked kyphosis, the 7-40 bronchoscope could not be passed beyond the limits of the right middle lobe.

The bronchial washings contained normal ciliated bronchial cells. No tumor cells were found.

Several hours after the bronchoscopy the patient died, and permission for autopsy was granted.

Postmortem Protocol.—The peritoneal cavity contains no fluid, but there are numerous delicate fibrous adhesions in both loops of terminal ileum and between the ileum and the lateral peritoneum. The sigmoid is adherent to the pelvic peritoneum, and the sigmoid colon contains many

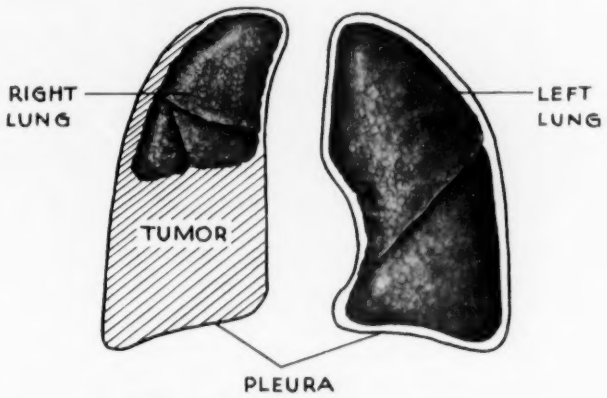

Fig. 2.—Schematic diagram of tumor.

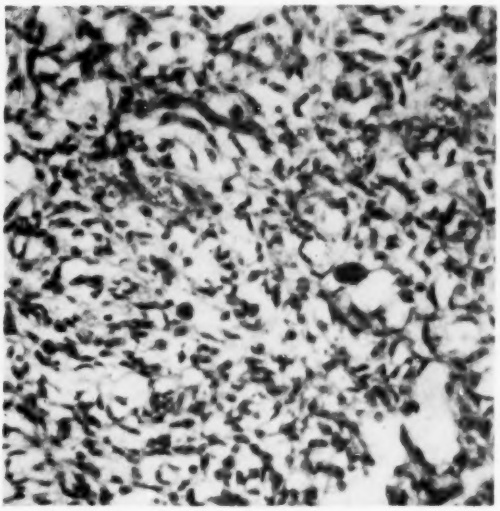

Fig. 3.—Rhabdomyosarcoma: areas of myxomatous tumor with scattered elongated cells.

0.5 cm. diverticulae. The uterus, right tube, and right ovary are surgically absent. The mesenteric lymph nodes are not enlarged. The height of the diaphragm on the left is at the level of the fifth intercostal space, and on the right it is at the level of the sixth intercostal space.

The right pleural cavity is obliterated. The right thorax is filled with a 1,600 gm. soft, white, translucent tumor, which occupies the lower two-thirds of the thorax. This tumor is densely adherent to the diaphragm, to the pleura, and to the diaphragmatic pleura of the lung. The

left pleural cavity contains neither fluid nor adhesions. There are no enlarged bronchial lymph nodes, and the thymus is not identified.

The right lung weighs 250 gm., and it is one-fourth its usual size, with the middle and lower lobes smaller than the upper lobe. The surfaces are wrinkled. The upper lobe is spongy, with

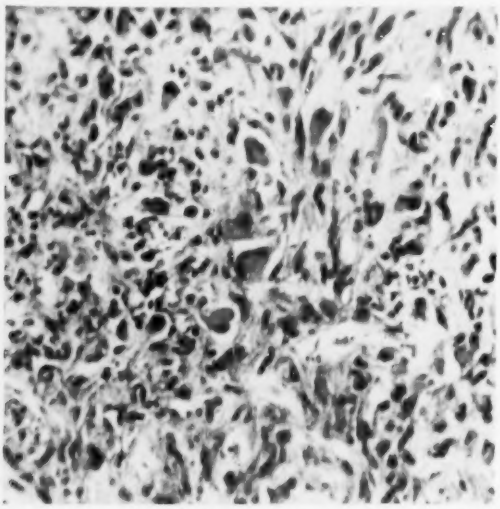

Fig. 4.—Rhabdomyosarcoma: irregularly shaped elongated cells and multinucleated tumor cells.

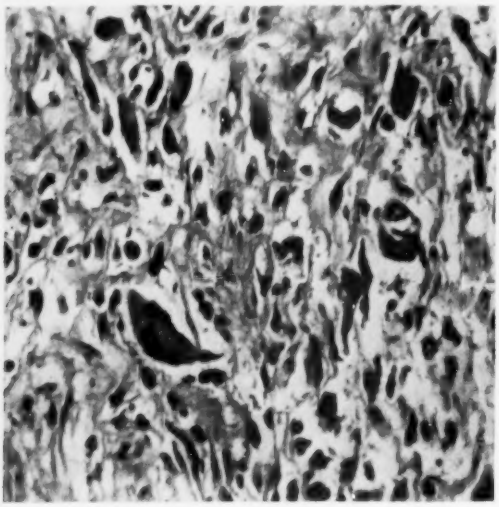

Fig. 5.—Rhabdomyosarcoma: large bizarre giant cells in a hyalinized stroma.

light pink cut surfaces, and the middle and lower lobes are meaty, with dark cut surfaces. The left lung weighs 350 gm. and is of average size. The upper lobe is smooth, pink, and crepitant and has pink cut surfaces, while the lower lobe is hypocrepitant and has dark-red cut surfaces, from which a moderate amount of frothy pink fluid can be expressed.

Microscopic description of the tumor shows that each of eight large sections of the tumor within the right thorax has a similar pattern, which is quite specifically that of rhabdomyosarcoma. There are large areas of loosely arranged elongated cells and extracellular, very light-bluish material. These are also bundles of more closely associated long cells with acidophilic cytoplasm and long oval nuclei with fine chromatin particles. Throughout the tissue there are numerous very large multinucleated cells with deeply acidophilic granular and often vacuolated cytoplasm; the nuclei are large, irregular, and very dark. There are also large tumor cells with short cytoplasmic processes, which represent "tadpole" cells.

On several sections there are margins of lung alveoli which are separated by a margin of subpleural fibrous tissue. The tumor is outside lung tissue. No normal striated muscular tissue is found, and one cannot say the tumor definitely arises from the diaphragmatic or the intercostal muscle, although such origin seems probable.

Anatomical Diagnosis.—Rhabdomyosarcoma of the right thoracic cavity; atelectasis, right lung; tracheobronchitis, acute; acute fibrinous pericarditis, slight, etiology undetermined; passive congestion of the lungs, liver, and spleen; arteriosclerotic kidneys.

SUMMARY

Rhabdomyosarcomas have been found in both striated and nonstriated muscles. Thus it is possible for them to originate in any muscle of the body.

At first we thought the tumor in this case may have had its primary site in the uterus, as the patient had a hysterectomy in 1944, but we were able to get the microscopic data, and the specimen was found to consist of myomatous uterus, with atrophy of the endometrium, spindle cell sarcoma of the myometrium, physiologic fibrosis of the ovary and tube, and coprostasis of the appendix. The autopsy did not show any evidence of recurrence of malignant growth in the pelvis or in the lymph nodes. Thus, we were dealing with two distinct tumors, both being sarcomatous.

The fact that this tumor did not metastasize was most surprising to all. It may have been a very slow growth, possibly owing to the fact that the patient was unable to walk for five years.

The intrathoracic tumor may have had its origin in the intercostal muscles or the diaphragm, but one wonders why it did not extend into the abdominal cavity or outside the chest.

123 Prospect St.

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NOTE ON PSEUDO-ORGANIC DEAFNESS

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SEVERAL children have been seen at this clinic within a six-month period presenting a hearing malfunctioning, which is best described as pseudo-organic deafness. They were, all three, referred by a school nurse. Each acted in class as if he or she had a hearing impairment. At home, too, there appeared this difficulty in understanding speech. When they are tested with an audiometer, a loss is indicated, and the curve resembles either a conduction impairment, with its evenly lowered threshold at all frequencies, or a perception impairment, with a steady decline in the higher frequencies. One child, a girl of 10, when tested three years previously yielded a similar audiogram to the one presented now.

In conversation at time of examination, these children manifest the same behavior as in the classroom and at home. The girl of 10 would say, "What?," "What?," at the same time coming closer as if in need of the amplification. On psychological testing all are well integrated and of at least average intelligence. However, an indication that the child does not have an impairment as serious as it appears, if present at all, is (1) the normal quality of speech and voice, and (2) the fact that if 10 objects are placed before the child and the examiner stands behind the child at 15 ft. (4.5 meters) and whispers the name of the object, the child quickly points to the object named.

One child of this group with a hearing aid on at minimal setting can hear and respond adequately to normally spoken speech, but without the aid and with the voice raised to an amplitude above that of the hearing aid at minimal setting the child responds as if he had severe hearing impairment.

While the 10-year-old girl was being interviewed, the mother said, with the girl sitting next to her, "She is an adopted child. When I first took her I thought she was normal and look what I got." The girl refuses to cooperate at home. When a year old, her body became "stiffened," according to her mother. She was taken to several pediatricians, and one diagnosed the condition as cerebral palsy, although none of the others who saw the child felt this was the nature of the condition. It is likely, and therapy will probably indicate it to be so, that the "stiffening of the body" and the hearing impairment are symptoms of the general resistance of the child to intrafamily relations. The girl was asked at one point to sit back, close the eyes, and just think of anything. While she was thus seated, I asked her several questions in normal voice. She answered quickly, indicating again that the hearing impairment was not a true one.

It is important that the true nature of similar cases be discovered. This child when seen three years ago had a very complete audiological survey, which was

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expressed in terms of percentage loss for pure tone, speech, social adequacy index, spondee and P B list results, etc. An aid was suggested, with very detailed suggestions as to how it might be best fitted to her hearing loss curve.

The aid did not result in any improvement in her interpersonal functioning, and the condition of resistance to her family is increasing. The central problem in these cases is not a sensory, but an interpersonal, one. The therapeutic approach should be psychological rather than mechanical.

SUMMARY

One case of pseudo-organic deafness is described in some detail. It resembles organic deafness because of the child's hearing difficulty in interpersonal situations and a consistent audiometric indication of loss resembling the conduction or perception loss curves. However, if a broader examination of the problem is undertaken, including voice and speech analysis, simplified word perception test, and a history of intrafamily dynamics, the diagnosis of organic loss must be abandoned. Psychological therapy, rather than a mechanical solution, is indicated.

This type of case is not to be classified in terms of a mechanical explanation of what occurs physiologically. All functioning is organic, and simply to describe what is taking place physiologically in terms of central nervous system functioning, i. e., explaining it in terms of a separate center for pure tone and for speech, does not offer a working hypothesis for therapy of the condition. The disorder is best understood as the mechanism whereby the person excludes, at convenient times, verbal communication.

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MEMBRANOUS CRYPTOCOCCIC NASOPHARYNGITIS (CRYPTOCOCCUS NEOFORMANS)

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AND
WILLIAM B. ARMSTRONG, M.D.
ATLANTA

AS A HUMAN disease cryptococcosis is found in many different areas of the world. It causes pulmonary infection, deep-seated abscesses, and skin lesions of a nodular type, and, more frequently in the Southern countries, it produces a low-grade type of fatal subacute meningitis.

The malady is also known as torulosis, or European blastomycosis, and as Busse-Buschke disease.[1] In the central nervous system the meningitis is slowly progressive, and is characterized by dizziness, vertigo, and stiff neck, with pain in the back and neck. There is a low fever and slow pulse, with the symptoms often simulating meningeal tuberculosis, with which it is often confused. Adults are most frequently affected.

According to Platt and Eynon,[2] who have made an excellent summary of cryptococcic infections, the first report of the condition was made by Sanfelice, and in 1901 Buillemin recorded the organism in the fungi group. The first case of meningitis due to this fungus was described by von Hansemann in Germany in 1905.

The infectious agent created great interest in the United States through reports by Stoddard and Cutler in 1916.

No one actually knows how the infection begins, but evidence at hand points to the pulmonary system; Benham isolated cryptococci from the human skin, but the cutaneous form is believed also to be indicative of a systemic involvement. Skin lesions, such as acneform and membranous lesions, have been observed. The fungus has also invaded the cervix, endometrium, Fallopian tubes, and even the adrenals. When the ailment is primary in the lung, it simulates tuberculosis, sarcoidosis, cancer, or Hodgkin's disease. Ordinarily the external lesions are characterized by a mild inflammatory chronic process with a gelatinous or myxomatous appearance.

For culturing, Sabouraud's or blood agar plates are preferable. Growth occurs in two to four days, producing mucoid, creamy colonies, the peripheral ones having a faint yellow, wrinkled edge; the material soon merges into a creamy coat which covers the entire agar field. Most cultures that we have encountered have a faint yeast-like odor. They consist of single, yeast-like cells, with small buds, which stain poorly by ordinary methods. Methylene blue stains the capsule, but often shows nonstaining centers. It is believed that there are at least 10 strains of cryptococci, and Evans [3] has differentiated these into three distinct serologic classes.

It would appear that more and more patients are suffering from fungous infections. This is certainly true in the Candida groups, which are believed by some investigators to be caused in part by the prolonged use of antibiotics. On the other hand, we should not forget that many fungi were probably imported by troops who

had trained and fought in the tropical countries during World War II. In the last few years methods of diagnosis and recognition have been improved, but the practice of mycology has narrowed to skin and specialty groups. There is now at hand a resurgence of interest. For instance, in our offices we have recently observed several new patients with different types of fungous lesions. There were patients with moniliases of the throat and oral passages, of the intestinal tract and lungs; there was another patient with sporotrichosis, one with actinomycosis, any number with trichophytosis; likewise, there were two people in whom we suspected coccidioidomycosis, and, lastly, the case here presented, coccidioidomycosis of the nasopharynx.

The patient was a white woman, H. C., of middle age, a widow, with one son 19 years of age, a practical nurse by avocation, who first came to one of us (W. B. A.) about Dec. 21, 1953. In her review of complaints, she stated that she had "taken a cold," Dec. 10, 1953, with a runny nose, which was stopped up and felt dry and parched. Shortly, much jelly-like mucus of slightly bloody gelatinous type was discharged from the nasal passages; the trouble then extended to her throat. She had a low fever, with a temperature of about 100 F. The throat was painful, and she felt miserable. She improved slightly but the membrane in the nasopharynx persisted. She had no attendant cough, night sweats, or chest pain at any time. She completely lost the sense of taste. The patient had never been to any foreign country, and only as far west as Ohio. For the past year she had been around a park where horses were kept for riding. She had never been exposed to anyone with any kind of disease, except a child whom she had nursed recently, who had leukemia.

On Dec. 22, the patient was referred to the laboratory of J. C. N. for the purpose of throat culture and smear, and other tests if necessary. The posterior upper uvula and nasopharyngeal area was plastered with a tenacious, creamy, jelly-like or mucinous membrane of an uncommon and unusual type. Some of the substance was pulled away for culture, microscopic staining, and sodium hydroxide mounts. Ordinary stains and hydroxide mount revealed nothing; however, a long-staining slide with methylene blue showed numbers of large coccoid spherical bodies, with smaller single buds very poorly outlined but sufficiently so for one to realize that the bodies were some type of cryptococci; bacteria of importance were absent. The blood study showed total leucocytes of 9,800, with 66% polymorphonuclear cells and 10% eosinophiles. Kahn serologic test was negative; x-ray chest negative. The parasites were demonstrated to several physicians, including W. B. A.

Cultures made on Sabouraud's medium produced growth in about three days, composed of a creamy-gray, whitish material, which rapidly coalesced on the surface of the slant in a uniform manner, having slightly raised edges of a light-brown tint. Smears of these colonies showed only round, single-contoured Torula bodies with an outside circular membrane and containing poorly staining central material, some having single buds. There were no joint forms or conidia; a faint yeast-like odor was present in the primary culture after about 10 days, but not in the transplants. Differential carbohydrate medium reactions were as follows: Dextrose and maltose fermented, gas slight; saccharic acid only; lactose not reactive; no surface growth; no chlamydospores formed on dextrose corn.

The patient's disease seemed to resist treatment, and the management of the problem appeared most difficult. Prior to the time of the laboratory diagnosis, one of us (W. B. A.) had administered antibiotics and sulfonamides, with unsatisfactory results. At a conference, we decided to try painting the upper nasal passages with methylbrosaniline chloride (gentian violet), 2%, alternating with hexylresorcinol solution (ST 37) in similar mixture. This was applied each day copiously, after removal of the membrane. Likewise, the patient was given tetracycline (Achromycin) and potassium iodide. She was also cautioned to gargle her throat at night with copious quantities of hot saline solution. On this regimen, much to our surprise and pleasure, the membrane, after about a week's time, began to recede and then disappeared, leaving an edematous, swollen, violaceous membranous base. The patient was impressed with her improvement and was very cooperative. When later observed, Feb. 17, 1954, she was cured as far as the local throat membrane was concerned, but was still having an uncomfortable feeling in her nasal passages,

from which she could occasionally extrude in small quantities a substance similar to that she had first noticed. However, her condition has improved so much that she has returned to her work, although she will be kept under observation.

We feel that this patient's disease should be reported because it had so many unusual features. First, there was no history of contact; second, neither was there evidence of skin or pulmonary priority; third, as far as we are concerned, we have never before encountered cryptococcic membranous nasopharyngitis, while, in contrast, moniliasis occurs commonly in the oral cavity. We reviewed an article by Campbell, Grekin, and Curtis, who reported four patients with coincidental cryptococcic lesions involving mucous membranes, such as the gums, hard palate, oral musoca, nasopharynx, nasal septa, and tonsillar pillars. The lesions were on violaceous-colored granular tissues, with ulcerations in some spots. Apparently the disease we have in mind is rare. Thus we did not have much information about the clinical diagnosis or treatment. However, one of us [4] had previously (in 1931) reported his experiments with a fungus of similar morphology, thought at that time to be a saccharomycete, in which the extraordinary curative effect of methylrosaniline chloride had been observed. On the basis of this report, it was suggested that methylrosaniline chloride in 2% solution, mixed with bismuth and hexylresorcinol, be applied vigorously. One cubic centimeter of bismuth salicylate in oil with chlorobutanol (Chloretone)—eight intramuscular injections—was also administered. Much to our pleasure, there were very marked beneficial results; thus, we would urge others to try this form of therapy. Intravenous methylrosaniline chloride solution could also be used in treating meningitis patients with cryptococcic invasion, and it might very well prove to be a life-saving agent.

138 Doctors' Bldg.

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IMPENDING ASPHYXIA IN AN INFANT FROM NOSE-DROP "REBOUND"

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THE "REBOUND" phenomenon, or swelling of the nasal mucosa, following the use of vasoconstrictor nose drops is well known and has received a considerable amount of attention in the literature.* If the use of the drops is continued it leads to a chronic obstruction of the nose from swelling and drying of the mucosa.[3] Less well known is the occurrence of nasal allergy, with swelling and hypersection, in infants under the age of one year. Still less well known is the very strong urge of the newborn and of infants to breathe through the nose exclusively.† The latter phenomenon has been discussed chiefly under articles on bilateral bony choanal atresia.‡ This urge to breathe through the nose should be given wider recognition. One article on clinical investigation of this urge was found.[11]

A combination of the above three factors confronted a pediatrician, and in turn me, in a recent case. Asphyxia to the point of cyanosis in an infant was present.

The 7-week-old infant (ninth child) was of normal birth. For the first two or three weeks respiration was quiet and health was perfectly normal. Shortly after solid foods were introduced, the child developed a "cold" without fever, the "cold" being characterized by partial obstruction of nasal breathing and a mucoid, colorless nasal discharge. The family physician supplied "alkaline and antiseptic" tablets, to be dissolved and used on cotton pledgets to swab the nares.

The child was first seen by me about three weeks later because of persistent noisy breathing. Ear, nose, and throat examination showed only a sleeping child whose respiration was noisy and rough. The origin of the noise was somewhere in the upper respiratory tract. The nasal mucosa was paler than normal and somewhat swollen. It bore on its surface an increased amount of colorless or white, frothy mucus. Air was passing through both nostrils. The possibility of an allergic rhinitis was not entertained because of the age of the patient and my preconceived ideas.

The tonsils were nonobstructive; the pharynx was not injected. In view of the bilateral nasal airway and the previous medication (whose nature was unknown at that time), it was recommended to the mother that she stop all medication and do nothing for the time being.

Two days later the child was taken to a pediatrician because of persistence of symptoms. His examination revealed an afebrile child with pale nasal mucosa and mucoid nasal secretions bilaterally. A throat culture yielded a hemolytic Streptococcus. The chest examination revealed only a few coarse rhonchi. The infant was given 0.12% phenylephrine hydrochloride (Neo-Synephrine) drops to be used in each nostril—gtt. 1, q.i.d. The pediatrician considered the possibility of "rebound" from the nose drops, but attempted to prevent it by giving elixir of diphenhydramine hydrochloride (Benadryl)—a misconception of the "rebound" mechanism. He also gave oral sulfisoxazole (Gantrisin) for the presumed streptococcic infection.

* References 1 and 2.

† References 4 to 7.

‡ References 8 to 10.

After three or four doses of nose drops, the child became worse. He breathed well immediately after each dose of drops, but within two hours he had more obstruction than before the drops were started.

Two days after the use of the nose drops had been begun, obstruction was very severe, and just after a feeding the infant was seen by the father to make four or five respiratory efforts with the mouth tightly closed. No air could pass the nose. The child became cyanotic. The father had enough presence of mind to open the child's mouth and hold the tongue down with his finger. This enabled the child to breathe well again. The pediatrician responded immediately to a call from the parents. His examination showed only swollen nasal mucosa with colorless secretion. Believing that the obstruction was due to the "rebound" phenomenon, he used some of the same nose drops which had been given two hours earlier. Within five minutes the infant breathed clearly through both nostrils.

The child was then brought to my office, where a nasal catheter (12 F.) was passed readily through each nostril to the nasopharynx. The diagnosis was obvious, but we were now faced with a real dilemma. How could we withdraw the offending nose drops and still maintain an airway for the child? Tracheotomy was reluctantly considered. Relays of nurses and assistants to hold the mouth open and tongue down for from 24 to 48 hours or more did not seem feasible. Some other methods, such as use of a nasal catheter, mouth-tongue props, etc., were encountered in later reading, but not thought of at the time. Nose-drop "rebound" is self-limited if the drops can be withdrawn; so it was predicated that if only one nostril was treated the other one might recover spontaneously. A trial of this was made. Phenylephrine hydrochloride, 0.12%, was used after 3, 6, 10, and 13 hours, one drop in the right nostril only. The child was kept on its right side so that the drops would not run into the left nostril. At the end of 13 hours the left, or untreated, nostril was sufficiently recovered that the child could breathe through it, although noisily. Nose drops were then completely withdrawn, and almost all symptoms were gone in four more days.

About two weeks later the child was given 1 tsp. of infant rice cereal and within one hour suffered diarrhea, vomiting, and a recurrence of the nasal obstruction. The infant recovered from this nasal obstruction spontaneously in 10 days. Obviously, nasal allergy had played a part in the original condition.

SUMMARY

Infants have a very strong tendency to breathe exclusively through the nose.

Nasal allergy does occur in infants and should not be forgotten in an etiological diagnosis.

Vasoconstrictor nose drops result in a period of relaxation or "rebound" of nasal mucosal vessels after the constriction phase is over. This produces nasal mucosa swelling.

These three factors acted together to produce cyanosis and impending asphyxia in a 7-week-old infant.

Successful treatment consisted of treating one nostril only with the vasoconstrictor drops. Recovery took place in 12 hours.

537 E. Market St.

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Clinical Notes, New Instruments and Techniques

NEW METHOD OF SUBTOTAL LARYNGECTOMY

Endolaryngeal Implantation of Thiersch Grafts

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LUXEMBOURG

Let us briefly recapitulate the usual technical procedure of a partial laryngectomy. After local anesthesia, either a preliminary tracheotomy is done, to test the patient's pulmonary reaction, or a nonstop operation is performed, that is to say, a tracheotomy immediately followed by a laryngectomy. The first step is a median incision of the skin from the upper edge of the thyroid cartilage to the inferior edge of the cricoid cartilage, followed by retraction of the soft parts, chiefly of the prelaryngeal muscles. The thyroid cartilage is thus denuded; the internal peri-

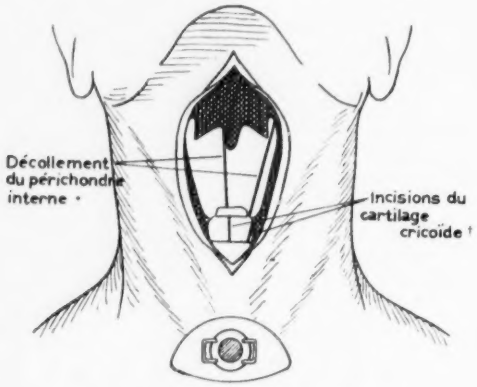


Fig. 1.—Cartilage incision lines.
* Exposure of the internal perichondrium.
† Incisions in the cricoid cartilage.

chondrium is exposed on the sound side along a paramedian line. The same procedure is used on the posterior part of the thyroid wing of the impaired side. A median incision of the cricoid cartilage, exposure of its internal perichondrium up to the posterior part of the ring, and section of the exposed part of the cricoid are the next steps. Up to this point the whole operation has been performed in a sterile field, the laryngeal mucous membrane not having been reached. The mucous membrane is reached by making an incision along the median line; the loose part thus formed is reflected, allowing inspection of the extention of the neoplasm. A broad excision through sound tissue is made, and finally a rather considerable fresh, raw surface exists, which has to be covered.

According to the old method, a Mikulicz drain is applied and remains in place for four or five days, after which time it is removed. The patient then has trouble with his saliva, polypoid formations, and purulent secretions.

The idea came to us to try the laryngeal implantation of a Thiersch graft removed from the thigh, spread on sterile linen, cut to measure, and applied on the raw surface. Hemostasis is carefully undertaken, and while the Thiersch graft is being taken and cut, a compress soaked with a thrombin solution is applied. The linen carrying the Thiersch graft is fixed to the skin edge of the laryngeal incision and may go beyond it. The close and elastic contact of the Thiersch graft with the raw surface of the operative site is ensured by a carefully placed Mikulicz drain. The laryngeal incision is left slightly open to allow the Mikulicz wick to drain to the

exterior in case it should soak up some endolaryngeal secretion. On the fourth day we change the internal Mikulicz wick for a new one, leaving in place the compress which forms the exterior covering of the Mikulicz drain in order not to disturb the fixation of the Thiersch graft.

On the eighth or ninth day we remove the whole Mikulicz drain as well as the linen that had carried the Thiersch graft, and we then have a clean laryngeal cavity, covered with a continuous

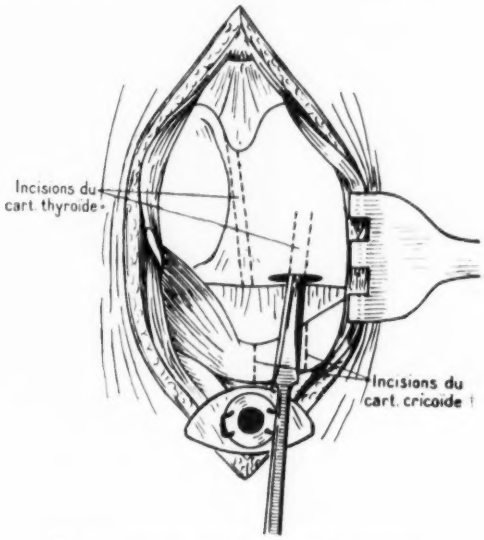


Fig. 2.—Interior perichondrium is exposed.
* Incisions in the thyroid cartilage.
† Incisions in the cricoid cartilage.

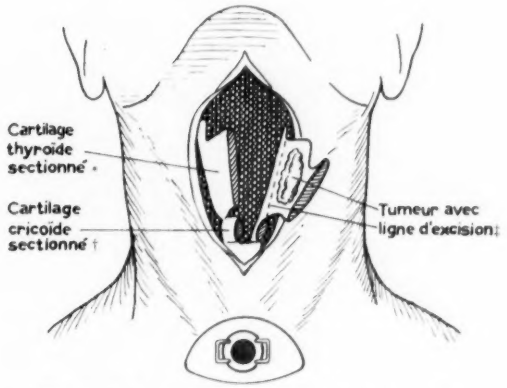


Fig. 3.—The mucocartilaginous flap is laid back.
* Thyroid cartilage sectioned.
† Cricoid cartilage sectioned.
‡ Tumor with line of excision.

epithelium without granulations or polyps. The median skin incision is closed after its edges have been freshened. The tracheal tube is removed, and the patient is in a condition to leave the hospital two weeks after surgical intervention.

We presented the following case before the Society of Medical Sciences of the Grand Duchy of Luxembourg:

The patient, M. B. A., was a 55-year-old man. He had a negative Wassermann test. Larynx biopsy showed an atypical, cylindrical-cell epithelioma of the ventricular band. We performed

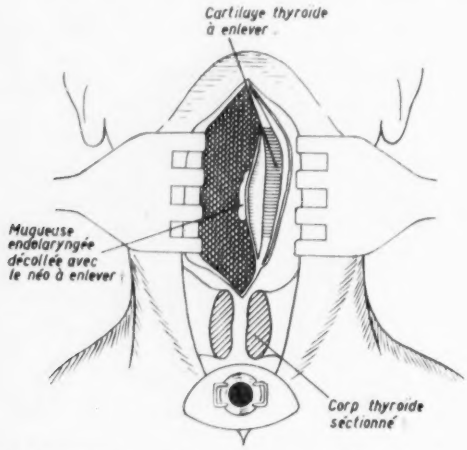


Fig. 4.—Interior perichondrium, carrying neoplasm, is laid back along with exterior perichondrium.

* Thyroid cartilage lifted up.

† Endolaryngeal mucosa freed, together with the neoplasm, to be removed

‡ Thyroid gland sectioned.

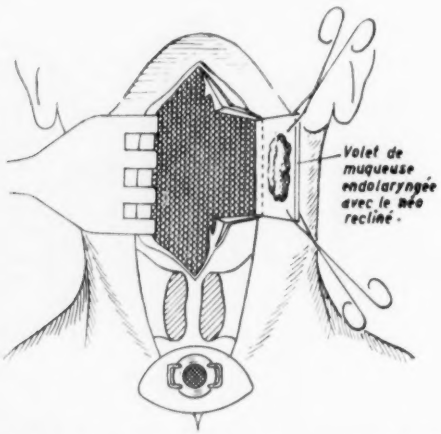


Fig. 5.—Thyroid cartilage lifted; laryngeal mucosa laid back.

* Flap of endolaryngeal mucosa with the neoplasm laid back.

a tracheotomy first, to test pulmonary reaction. After surgical intervention the patient had a temperature rise to 39.5 C. (103.10 F.). After the fever subsided, we did a hemilaryngectomy according to the above-mentioned method and noted a total absence of any inflammatory reaction. The patient stood the hemilaryngectomy remarkably well; it produced almost no reaction. The

reaction was far less than in the tracheotomy, which, however, is considered to be a much milder procedure. We observed the development of the endolaryngeal Thiersch graft, and it always presented a clean surface, without any reaction.

According to the method which we used, the endolaryngeal Thiersch graft is applied at different stages of laryngeal surgery, thyrotomy with simple cordectomy, or thyrotomy by a modified St. Clair-Thomson method, which we want to mention briefly. After anesthesia, a median skin incision is made, and the perilaryngeal parts are exposed without denuding too

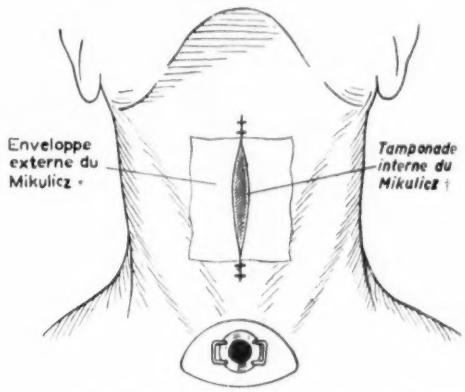


Fig. 6.—Appearance after insertion of the Mikulicz drain.
* External covering of the Mikulicz drain.
† Internal tampon of the Mikulicz drain.

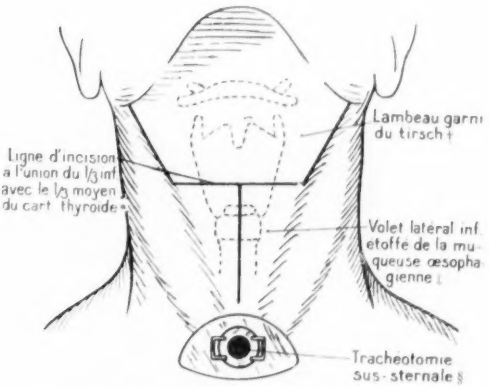

Lambeau garni du tirsch †
Ligne d'incision a l'union du 1/3 inf avec le 1/3 moyen du cart thyroide *
Volet lateral inf etoffe de la muqueuse œsophagienne ‡
Tracheotomie sus-sternale §

Fig. 7.—Skin incision lines for total laryngectomy.
* Line of incision at junction between lower and middle thirds of thyroid cartilage.
† Flap provided with Thiersch graft.
‡ Lower lateral flap supported by esophageal mucosa.
§ Substernal tracheotomy.

much of the cartilage. The thyroid cartilage is opened medially with Moure scissors; the internal and external perichondria are retracted, and the corresponding part of the thyroid cartilage is excised. The lesion is removed by a large excision in sound tissue. Careful hemostasis, thrombin compress, and application of the linen carrying the Thiersch graft are the next steps. Postoperative treatment is the same as that mentioned above, that is to say, changing the internal

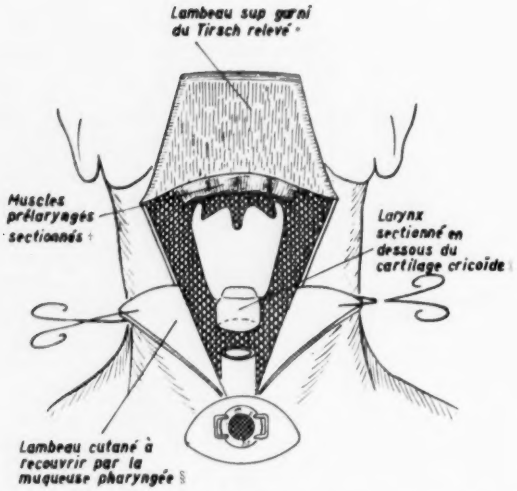

Lambeau sup garni du Tirsch relevé *
Muscles prélaryngés sectionnés †
Larynx sectionné en dessous du cartilage cricoïde ‡
Lambeau cutané à recouvrir par la muqueuse pharyngée §

Fig. 8.—Trachea sectioned above cricoid; larynx lifted up from below.

* Upper flap provided with Thiersch graft reflected.

† Prelaryngeal muscles sectioned.

‡ Larynx sectioned below cricoid cartilage.

§ Skin flap to be covered by the pharyngeal mucosa.

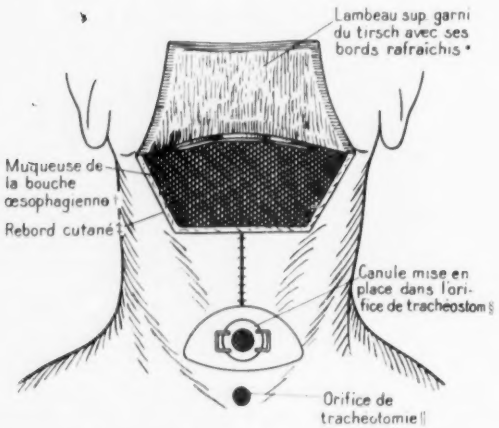

Lambeau sup garni du tirsch avec ses bords rafraichis *
Muqueuse de la bouche œsophagienne †
Rebord cutané ‡
Canule mise en place dans l'orifice de trachéostom §
Orifice de tracheotomie ||

Fig. 9.—The median incision is sutured, and the loose part covered with the Thiersch graft is lifted.

* Upper flap proved with Thiersch graft with its edges freshened.

† Mucosa of esophageal opening.

‡ Skin edge.

§ Cannula in place in tracheostomy opening.

|| Tracheotomy opening.

Mikulicz tampon on the fourth day and removal of the whole on the eighth or ninth day. In case of total laryngectomy, the skin incision follows the inner edges of the two sternocleidomastoid muscles to join a horizontal incision passing between the inferior third and the middle third of the thyroid cartilage. This dissected flap is covered by a Thiersch graft for 8 to 10 days. The tracheotomy is above the sternum. Then, during the total laryngectomy, a median incision is made to below the cricoid, exposing the whole prelaryngeal zone. The muscles are cut. The trachea is cut across below the cricoid, and the larynx is removed from below to above, taking great care of the mucous membrane of the esophagus. The laryngectomy is now completed, and the inferior

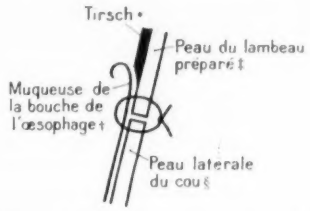


Fig. 10.—Method of suturing the pharyngoesophageal mucosa to the skin.
* Thiersch graft.
† Mucosa of the esophageal opening.
‡ Skin of the prepared flap.
§ Lateral skin of the neck.

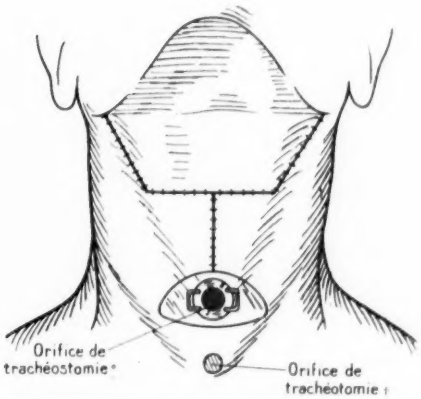


Fig. 11.—Appearance after skin is sutured.
* Tracheostomy opening.
† Tracheotomy opening.

median skin incision is sewed. The pharyngoesophageal mucous membrane is fixed to the skin junction thus formed; it is sewed in such a way as to cover the line of the skin stitches along the whole of its extension.

For nourishment of the patient we give 1 liter of Baxter's solution * intravenously for two days; we then give the solution by mouth or use the classic method of the gastric tube passing through the larger nostril.

* Baxter's solution is a nutrient solution containing 5 gm. of protein hydrolysate, 5 gm. of dextrose, and 50 mg. of sodium bisulfite, with pyrogen-free distilled water added to make 100 cu. ml.

Endolaryngeal grafts have been prepared with whole skin, but to guarantee the success of the graft one is obliged to prepare it three weeks before use to "autonomize" it, as we say in plastic surgery. In practice, whenever a neoplasm presents itself, and before carrying out an operation, we are obliged to have proof showing that we really do have a neoplasm. We are, therefore, obliged to do a biopsy, and we are forced to wait for the result; in other words, we must wait for a month before undertaking active therapy. Every biopsy specimen taken, however, stimulates an evolving neoplasm, as we have repeatedly observed. This occurred in the case mentioned above. We therefore wish to mention the following advantages of the method: the minimum of postoperative care; the rapidity of cicatrization; the absence of infected polypoid formations, which can be a cause of fatal pulmonary complications, and the almost total absence of reaction. The Thiersch graft exercises its antiseptic power, which is well known and has long been made use of in bone surgery; it prevents the detrimental action of saliva on the raw surface of the operative site, which in a space of 8 to 10 days is covered with a resistant epithelium that allows the liquid no deleterious contact. If, however, the saliva succeeds in infiltrating into the cavity in spite of the graft, it is sucked up, so to say, by the mechanical aspiration exercised by the internal tampon of the Mikulicz drain through the slightly open orifice of the laryngeal incision.

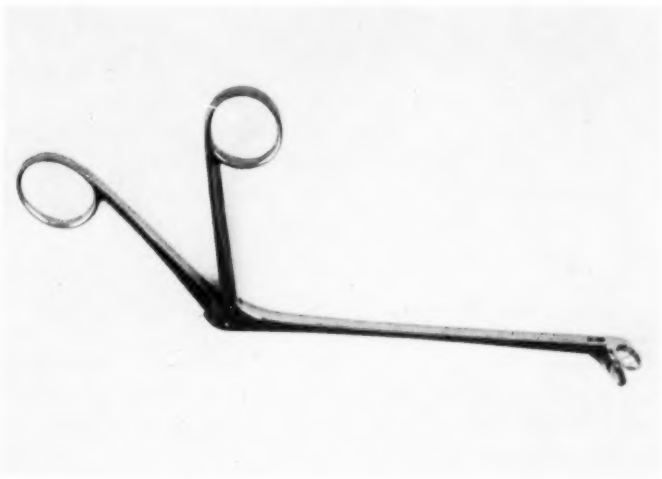
We are convinced that a reduced mortality, and even a minimum of fatal cases, will be the consequence of using a Thiersch graft, and we feel sure that the method is likely to change completely the prognosis of laryngeal surgery, up to now charged with such heavy mortality.

43 Bd. de la Pétrusse.

AN ADENOID-BITING FORCEPS

FORDYCE JOHNSON, M.D.
PASADENA, CALIF.

A routine close examination of the adenoid during a tonsillectomy and adenoidectomy has impressed upon me the need for an instrument to remove more adequately remnants of adenoid tissue in this area. The presence of pieces of adenoid tissue in the higher area of the nasopharynx, and even into the posterior choanae, following an adenoidectomy has been nearly a routine finding, confirmed by the constant use of a large laryngeal mirror to recheck the adenoid area during



Adenoid-biting forceps.

surgery. The instruments available did not give me ease of access to this area. The adenoid-biting forceps has been devised for this purpose. It presents a right-angled biting surface, allowing an additional ½ in. (1 cm.) and more of bite into the region of the choanae and fossae of Rosenmüller. Use of this instrument has given a cleaner adenoid bed at the termination of the adenoidectomy.

The adenoid-biting forceps is also a useful instrument in removing adhesions in the nasopharynx, those to the posterior wall, and those between the tip of the Eustachian tube and the vault of the nasopharynx. The preferable technique is to excise such adhesions rather than merely to section them.

The instrument is available through George P. Pilling & Son Co., 3451 Walnut St., Philadelphia.

The use of the adenoid-biting forceps does not mean exclusion of the use of the adenotome or adenoid curet. It is wise to keep cutting of tissue in this area to a minimum, to minimize bleeding. The instrument that I am presenting is to be used to remove those loose ends of adenoid tissue left after the routine adenoidectomy.

In performing the tonsillectomy and adenoidectomy surgery, I sit at the head of the patient, use the Davis mouth gag (with the gag supported by a Mayo stand) and the head-low position, thus draining all the blood toward the nasopharynx. By using suction, and a large laryngeal mirror, dipped in green soap, then wiped to prevent fogging, I have a clear view of the nasopharynx. The soft palate is readily elevated by the presence of the shank of the adenoid-biting forceps, so that tags of adenoid tissue are readily picked up.

98 N. Madison Ave.

Progress in Otolaryngology

TUBERCULOSIS

Summaries of the Bibliographic Material Available in the Field of Otolaryngology for 1947-1951

GEORGE E. WILSON, M.D.
AND
WILLIAM K. STERN, M.D.
SARANAC LAKE, N. Y.

INTRODUCTION

ALMOST six years have elapsed since we reported on the progress in the field of tuberculosis of the upper respiratory tract. During this interval considerable progress has been made in the treatment of tuberculosis, particularly since the discovery of streptomycin and paraaminosalicylic acid (PAS). Since the clinical results of the combined use of the two drugs have begun to appear in the international literature, it has become increasingly difficult for us to keep up to date on this particular aspect of otolaryngological tuberculosis. The number of papers published on streptomycin and PAS therapy and on the clinical results and complications are most formidable. At the same time, the major indexing surveys have lagged chronologically behind the countless and dispersed publications.

Another drug of therapeutic interest in the treatment of lupus and tuberculous lymphadenopathy proved to be calciferol, which apparently was found to be of great value in Europe, but so far has not caused much interest in the United States, judging by the scarcity of domestic papers on the subject.

Paraacetylaminobenzaldehyde thiosemicarbazone (Tibione), which appeared in a great many references in postwar German literature, was tried out in some of the American tuberculosis centers, with much less satisfactory results than in Europe.

Isonicotinic acid hydrazide (Isoniazid), the latest addition to the antituberculous formulary, shows definite promise, but its impact in the specialized field of otolaryngology remains to be seen. Most literary references so far report the effects on pulmonary and systemic tuberculosis rather than on tuberculosis of the upper respiratory tract. From our own experience we would gather that the therapeutic results of isoniazid do not match those obtained by the combined and long-term streptomycin and PAS therapy.

CLINICAL RESULTS OF STREPTOMYCIN TREATMENT

Streptomycin was discovered by Waksman [1] and Schatz [2] during World War II, and after their original communications, considerable time elapsed because of wartime restrictions on production and distribution of the drug before the first clinical results of its use were published. One of the first reports describing satisfactory results of the use of streptomycin in a case of laryngeal tuberculosis came from the Mayo Clinic, where Figi, Hinshaw, and Feldman [3] treated a 32-year-old woman with papillary tuberculous laryngitis. Upon admission this patient complained of hoarseness, had slight productive mucoid expectoration, and apparently did not reveal any pulmonary tuberculosis; this was therefore one of the first cases in

which the effect of streptomycin on tuberculous laryngitis could be observed. She received 34 gm. of the drug during 45 days, by both injection and aerosol inhalation. Regular examinations by laryngoscopy showed improvement in the papillomatous lesions after 10 days and healing at the end of six weeks. Sputum and culture, which were positive for tubercle bacilli at the onset, turned negative 27 days after institution of treatment. Follow-up examinations confirmed that the tuberculous process was arrested, and the authors stressed that the regression of the specific lesions succeeded faster than under any other antituberculous medication known up to that time.

At the end of 1946 a second paper was published by Figi and Hinshaw,[4] reporting on four cases of laryngopharyngeal tuberculosis treated with streptomycin. The morphological findings included an indolent verrucous tuberculoma, multiple ulceration of the hypopharynx, and extensive ulcers of the epiglottis. Healing of the ulcers and granulations under streptomycin, which was administered intramuscularly and by aerosol nebulization, took between 17 and 56 days.

A more extensive survey of 100 patients with various types of tuberculosis treated with streptomycin and observed for two years by Hinshaw, Feldman, and Pfuetze[5] included seven cases with upper respiratory lesions. At the time of publication five of the seven patients showed improvement, while the remaining two were still under observation. The dosage at that time was still comparatively high, 1 to 3 gm. divided into four to six doses daily, with aerosol inhalations for the patients with laryngeal tuberculosis. The drug was given for two to four months, up to a total of 360 gm. of streptomycin. The majority of cases showed toxic reactions to the drug; these reactions will be discussed under a separate heading.

Hinshaw,[6] one of the pioneers in the clinical study of streptomycin, lectured at the Pasteur Institute in Paris in July, 1947, and among the indications for the use of the drug he stressed laryngeal and oropharyngeal lesions. At the same time he warned against vestibular disturbances and deafness as untoward side-effects.

Administration of the drug by aerosol inhalation in addition to the parenteral route was advocated by Fishburn, Fisher, and Wallace,[7] who used 2 to 3 cc. of 50,000 units per cubic centimeter four to five times daily for several months. Cases of lymphadenitis which were still found to be active after a course of streptomycin received additional x-ray radiation.

On Feb. 1, 1947, the pharmacology of streptomycin was described in the *Journal of the American Medical Association*,[8] without any clinical evaluation of the drug at this early date.

Four months later Hirshfeld and Buggs[9] published a more detailed discussion on the status of streptomycin therapy, discussing drug standardization, bacterial spectrum, development of drug resistance, blood level determinations, and the pharmacological factors of absorption, distribution, excretion, and toxicity in the body tissues. Their survey included clinical indications for the use of streptomycin, without particular emphasis, however, on tuberculosis of the upper respiratory tree.

One of the first case reports from abroad came from Vergelin and Cohen Rua,[10] who gave the history of ulcerative tuberculosis of the larynx with aphonia in a patient with advanced bilateral pulmonary tuberculosis. After unsuccessful attempts with the conventional therapeutic means, the patient received 1 gm. of streptomycin

daily for almost six weeks. Hoarseness subsided four days after the institution of drug therapy, and during the weeks following, both the pulmonary and laryngeal processes showed satisfactory improvement.

On the West Coast, Bogen [11] and his staff were among the first to evaluate streptomycin clinically. In an address before the Medical Section at the 52nd Annual Session of the National Medical Association in Los Angeles, he summarized the indications for the use of streptomycin, and its therapeutic effects, stressing its particular value in the treatment of laryngeal, tracheobronchial, and oral tuberculosis, the gratifying results in ulcerative and granulomatous forms, and its usefulness in draining sinuses caused by tuberculous lymphadenopathy. The lecture was probably based on a previous and more detailed account published in November, 1947,[12] which contains the breakdown of the case material. Thirty-four patients at Olive View Sanatorium, all with moderately or far advanced pulmonary and laryngeal tuberculosis, were treated with streptomycin. Twenty-eight of the total number had been treated previously by conventional methods, without any definite improvement; the remaining six patients apparently received streptomycin as primary therapy. The drug regimen consisted of 0.5 to 2.0 gm. of streptomycin intramuscularly in addition to 0.5 gm. by aerosol inhalation. Of the 34 patients, 13 were considered healed, 17 improved, and the remaining 4 unimproved or worse. A comparative group of 30 patients treated during the previous year with glucosulfone sodium (Promin) and penicillin aerosol showed only 7 patients apparently healed, 7 improved, and 16 unimproved or worse. Here is one of the first clinical attempts to compare the effects of conventional therapeutic means with those of the new drug, clearly attesting to the higher efficacy of streptomycin in the treatment of laryngeal tuberculosis, an observation which was to receive countless confirmations in the year to come.

Black's [13] article in the *Transactions* of the *National Tuberculosis Association* is apparently based on the same clinical study as the previous papers.

McGovern and Broome [14] add two case histories illustrating the effects of streptomycin on laryngeal tuberculosis. The first describes a 27-year-old man with pulmonary tuberculosis and extensive tuberculous ulceration of the right arytenoid and the right ventricular band. He received 1 gm. of streptomycin for eight days and then 1.5 gm. for nine weeks, both intramuscularly and by spray. Two weeks after the institution of the treatment, the patient experienced relief from his dysphagia and pain, and after another two weeks there was considerable structural improvement of the ulcerative lesions, which appeared healed after termination of the drug treatment.

The second case history presents a 30-year-old man with dysphagia, a tuberculous ulcer, and edema of the epiglottis, who was put on a similar streptomycin regimen and also showed considerable improvement of his laryngeal lesions and disappearance of dysphagia, permitting better nutrition. In contrast to the first case, however, his moderately advanced pulmonary tuberculosis did not show any appreciable change.

Another major clinical survey came from Belgium, where Arnaud [15] treated with streptomycin 85 patients with open pulmonary tuberculosis and secondary laryngeal-pharyngeal involvement. One group of 67 cases received 1 to 1.5 gm. of streptomycin daily, up to a total of 50 to 200 gm. Among this group, 62 patients lost their dysphagia and gained weight; 46 regained their voices (20 completely,

26 partially). In 23 cases there was complete morphological healing of the specific lesions; in 33, partial structural improvement; 6 were not influenced, and 11 became worse. Pathological breakdown of the case material showed 10 miliary cases, of which 4 were healed, 5 improved, and 1 became worse; 19 cases with infiltration and edema, of which 9 were healed, 9 improved, and 1 became worse; 32 cases with ulceration and granulation, of which 10 were healed, 19 improved, and 3 became worse.

The second group consisted of the remaining 18 patients, who received 0.25 to 0.5 gm. of streptomycin daily by aerosol inhalation, which proved less satisfactory as a therapeutic route.

Another publication from Belgium, by de Prest,[16] is based on 20 years' experience in the field of tuberculosis, covering about 5,000 patients hospitalized for pulmonary tuberculosis, with an incidence of almost 13% (648 cases) suffering of secondary laryngeal tuberculosis. The mortality rate in the pulmonary-laryngeal group was about 30% before 1940; during a 7-year period (1940-1947) the incidence of laryngeal tuberculosis dropped to 6 to 8% and the mortality rate to 23%.

Prior to 1947 the therapeutic management consisted in general institutional regimen, rest, collapse measures, vocal silence, and galvanocauterization.

In 1947 streptomycin was introduced, and a group of 25 patients is analyzed who received 1 gm. of the drug daily in three injections for an average of 60 days. The author emphasizes the prompt relief of dysphagia and hoarseness after institution of streptomycin therapy, the gradual regression of edema, and the healing of ulcerations. He did not observe any serious drug reactions, which is somewhat in contrast to the reports in publications in the United States at that time. Among the indications all exudative lesions are included, while productive and mixed type processes did not always result in complete repair. An extensive bibliography supplements this paper.

Dupont [17] reports briefly on 26 cases of tuberculous ulceration of the upper respiratory tract, all of which were healed or improved on streptomycin treatment. His dosage was 1.5 to 3 gm. daily in divided doses every three hours, up to a total of 25 to 112 gm. In view of the high dosage, it is not astonishing that 50% of his patients had vestibular reactions.

One of the earliest contributions to the Italian literature on streptomycin came from Ferreri,[18] who used the drug by both intramuscular injection and aerosol inhalation, with gratifying results, in miliary infiltrations and ulcerative forms of laryngeal tuberculosis, but found that in the hypertrophic forms the response was less prompt. He advocated the combined use of streptomycin and chaulmoogra oil in tuberculous involvement of the posterior section of the larynx, arguing that the oil has a dissolving action on the waxy capsule of the tubercle bacillus and therefore facilitates the attack of the antibiotic.

Fiori and Staffieri [19] used aerosol streptomycin, with excellent results, in tuberculous ulcerations of the larynx. Infiltrations and edemas were improved but not healed by the drug, while the hyperplastic lesions showed hardly any change. The author very soundly observed that, in spite of the beneficial action of streptomycin, improvement of the laryngeal lesions still depends on the course of the primary pulmonary process.

Another attempt to evaluate aerosol streptomycin in laryngeal tuberculosis was made by Larroudé,[20] who used 1,000,000 units of 20 cc. of isotonic sodium chloride solution, dividing it into eight daily applications of 2.5 cc. each. The six cases of laryngopulmonary tuberculosis treated all showed marked relief from dysphagia and pain, improvement of hoarseness and nutritional status, decrease of secretion and infiltration, and good scarring of ulcers. The final results, however, were less gratifying, with two of the six patients dying of pulmonary deterioration.

In May, 1948, Pfuetze and Ashe[21] summarized the status of streptomycin therapy, discussing its use in pulmonary tuberculous empyema and extrapulmonary lesions. They obtained their most satisfactory results in ulcerative and granulomatous lesions of the larynx, which showed an initial response after two weeks and healed within an average of six to eight weeks, while the oropharyngeal lesions needed up to three months to show good therapeutic results. The authors rightly considered the intramuscular injection as the method of choice and discarded aerosol alone as ineffective. Draining cutaneous sinuses from tuberculous lymph nodes as a rule responded promptly to streptomycin; a few refractory cases, however, showed recurrence of drainage and glandular enlargement. The closure of open sinuses was facilitated by surgical removal of pus and necrotic material.

In a paper read before the Phthisiological Society at Montreal, Canada, in March, 1948, Brahy[22] discussed the etiology and morbid anatomy and the clinical course and treatment of laryngeal tuberculosis. In addition to reiteration of the traditional therapy, the author presents his experience in approximately 100 cases treated with streptomycin. The patients received 0.5 gm. of the drug twice a day for about three weeks and showed remarkably prompt symptomatic relief followed by structural improvement toward the end of the therapy. The improvement was especially marked in granulations and ulcers.

Quesada[23] emphasizes the value of streptomycin in treatment of tuberculosis of the larynx, trachea, and bronchi. This publication is founded on the author's experience with six patients, some of whom received the drug by nebulization in addition to the parenteral administration. The dosage given daily was 1.5 to 2 gm., up to a total of 20 to 30 gm. Two case histories are described in detail.

One of the outstanding publications on streptomycin therapy came from Switzerland and consisted of a collection of articles edited by Professor Fanconi,[24] Director of the Children's Hospital of Zurich University. Of particular interest in this survey is the clinical experience of Russi,[25] who was among the first to try out streptomycin in patients with laryngeal tuberculosis at Davos, Switzerland. He obtained his best results in the early and exudative lesions of the larynx, while the predominant productive forms still responded better to electrocauterization. He dispensed 1 gm. of streptomycin daily intramuscularly, up to a total of 30 to 100 gm. without obtaining any permanent cochlear damage. Among the vestibular disturbances he mentions vertigo and dizziness, occurring usually after the administration of 50 to 70 gm. and disappearing promptly upon cessation of treatment. Aerosol inhalations were abandoned at an early date because of anorexia, nausea, vomiting, and the absence of morphological improvement.

The second part of Russi's study consists of the clinical description of five cases: (1) tuberculous ulcer of the left vocal cord, completely healed with 50 gm. of streptomycin; (2) extensive ulceration of the epiglottis and left part of the larynx, with dysphagia, inanition, and hoarseness, completely healed after 105 gm. of

streptomycin; (3) extensive ulceration of the pharynx and right posterior pillar, with satisfactory epithelization and cicatrization after 42 gm.; (4) tuberculous ulcer of the tongue, healed after 105 gm.; (5) left tuberculous otitis media in a 6-year-old boy with multiple perforations of the ear drum, which scarred after topical application of streptomycin, with considerable improvement in hearing.

Soulas and Guillon [26] relayed their results in a case of tuberculous laryngitis treated with 0.5 gm. of streptomycin daily. After eight days there was the usual symptomatic relief, and after six weeks they observed cleaning of the ulcers and contractive regression of the infiltration. This trend toward stenosis is observed not infrequently in streptomycin therapy. The drug should be reserved for only severe cases of laryngeal tuberculosis, an opinion not shared by the majority of clinicians.

Guillon and Fouquet [27] observed prompt clearing of tuberculous ulcers and laryngeal infiltration, with relief of dysphagia, on steptomycin therapy, and remarked on the frequency of vestibular disturbances. Improvement of the laryngeal lesions was often faster and more pronounced than the clearing of the pulmonary disease.

In a report to the Committee on the Management and Treatment of Diseases of the Chest (1948) [28] streptomycin was considered the drug of choice for tuberculosis of the pharynx, larynx, and tracheobronchial tree, to be administered intramuscularly in a daily dose of 0.5 to 2 gm., according to the body weight of the patient and the extent of the tuberculous involvement, to be given from six to eight weeks. A preliminary report from Fitzsimons General Hospital stated that intermittent doses at three-, four-, and five-day intervals proved equally effective and less apt to cause drug resistance. This recommendation was later confirmed by numerous observations all over the nation, and the biweekly injection schedule finally became accepted practice in most institutions.

Albertal, Dobric, and Rodriguez Olivares [29] published their study of 50 cases of pulmonary tuberculosis treated with streptomycin, which included patients with secondary extrapulmonary spreads. They reported improvements in tuberculous ulcers of the tongue and larynx and disappearance of Isambert's syndrome associated with hemotogenous disease. They used 1 gm. of the drug daily, divided in five doses, without serious complications. The toxic effects from the streptomycin were easily reversible. The authors were particularly interested in the appearance of eosinophilia as a sign of drug allergy, and they maintain that a rapid rise in eosinophiles and their persistence on an increased level gave a rather unfavorable outlook for the efficacy of streptomycin and that better therapeutic results could be expected when they observed only a slight rise in eosinophiles, which rapidly descended to a normal level during the treatment.

One of the more important contributions in the early streptomycin era was made by Bunn,[30] who delivered a speech before the American College of Chest Physicians in Atlantic City, N. J., June 8, 1947, drawing on the case material of 650 patients in a Veterans Administration Hospital, of whom 80% were treated uniformly according to protocol, receiving 1.8 to 2 gm. of streptomycin daily in five to six doses for an average of 120 days. This large survey included 73 cases of ulcerative tuberculosis of the upper respiratory system, including the tracheobronchial tree, and 10 cases of tuberculosis of the tongue. The results were most gratifying, showing a therapeutic response of the pharyngeal, laryngeal, and lingual lesions, beginning as early as seven days after institution of treatment and continuing far into

the third month. Intramuscular injection was the route of choice, while aerosol nebulization and topical applications were rightly considered to be insufficient, because of their inability to produce adequate blood serum concentration. Healing occurred in the large majority of mucosal lesions regardless of their extent, pathological type, and the fate of the basic pulmonary process. The rapidity of improvement was considered to be remarkable by comparison with the old conventional therapeutic measures preceding the discovery of antibiotics.

In addition to the analysis of therapeutic effects in this impressive survey, an equal amount of attention was given to the charting of toxic reactions, among which injury to the eighth nerve ranked first; 95% of the 650 cases showed impairment of vestibular function, dizziness, and vertigo, which usually occurred between the third and fifth weeks of continued therapy. As a rule, loss of balance was compensated after a transitory stage, but cases with irreversible destruction of the labyrinth and permanent functional damage were also observed, confirmed by follow-up examinations after cessation of drug therapy. The auditory branch of the eighth nerve was affected by high concentrations of streptomycin given over long periods, resulting in various degrees of impairment from partial to total deafness. This feature, however, as a rule progressed slowly, allowing an early warning to discontinue the drug before irreversible damage was done. Partial loss of hearing often proved reversible, while complete deafness proved permanent. Discussion of anaphylactic reactions, such as exfoliative dermatitis, skin rashes, eosinophilia, circumoral paresthesia, renal demage, and bone marrow depression, concludes this study.

Bernard and Arnaud [31] report on 70 cases of pharyngolaryngeal tuberculosis treated with streptomycin. They applied the drug by both the parenteral route and aerosol inhalation and found the latter method to be far inferior as to therapeutic efficacy. Almost all the cases with dysphagia improved on streptomycin, while about one-half the cases with hoarseness showed a favorable symptomatic response. Among 56 cases treated by intravenous injections, structural healing occurred in 19, improvement in 27, while 6 remained unchanged, and 4 became worse. Sputum conversion was obtained in 20 cases. The article contains a detailed breakdown of the case material as to the type of pharyngolaryngeal lesion and associated pulmonary process, with respective changes under streptomycin therapy.

In conclusion, the authors state that the drug is of definite value for both symptomatic relief and structural improvement in pharyngolaryngeal tuberculosis, especially for lesions involving the oropharynx and in Isambert's disease.

Leroux, Bourgeois, LeMeur, and Preau's [32] article is a contribution on the use of streptomycin by aerosol inhalation, with which they treated 36 patients with tuberculous laryngitis and which they found to be unsatisfactory in contrast to their results with intramuscular injections (1 gm. per day for four to six weeks), which caused rapid symptomatic relief of dysphagia and pain, often as soon as the fourth or fifth day after the institution of therapy. They considered the morphological response less impressive; the results were relatively satisfactory in edema, inconstant in ulcers, and least conclusive in infiltrative lesions. Some improvement continued after cessation of drug therapy. The authors felt that topical application of tyrothricin was as effective as intramuscular streptomycin and have recommended the combination of the two drugs in severe cases.

COMPLICATIONS OF STREPTOMYCIN THERAPY

Interest in the complications during streptomycin therapy went parallel to the therapeutic developments of the drug and brought forth a prolific amount of discussion and references. The highly toxic doses of the earlier days gave rise to severe drug reactions, and it is interesting to note how the industrial purification of the antibiotic and the more conservative dosage schedule were reflected in the literature by the lessening of complications, which became more transient and less damaging.

One of the early major surveys on otic complications of streptomycin therapy came from Fowler and Seligman,[33] who treated 81 patients with 3 gm. of streptomycin daily. Auditory and vestibular disturbances usually developed between the 17th and 20th days after the onset of treatment. The deafness was transitory in the majority of cases, and vertigo frequently decreased while the patient was still undergoing therapy. Two months after termination of treatment only 3 patients out of the 81 still showed absence of vestibular response. Audiograms and vestibular tests should be taken before the institution of streptomycin therapy, and their outcome should be considered, to give timely warning for toxic reactions. The study, incidentally, does not comprise patients with tuberculosis of the lungs or upper respiratory system and is interesting mainly as an early warning against risks involved in high streptomycin dosage.

Farrington, Hull-Smith, Bunn, and McDermott[34] gave a clinical description of the different types of toxic reactions occurring during streptomycin therapy, which fell into four categories:

1. Histamine-like reactions (flushing, headache, hypotension)
2. Various manifestations of anaphylaxis (pruritis, maculopapular eruptions over trunk and extremities, fever, nausea, vomiting, eosinophilia)
3. Neurological symptoms (vestibular and auditory damage)
4. Signs of renal irritation (cylindruria, mildly impaired renal function)

Vestibular symptoms appeared rather uniformly on the 21st day of treatment. All patients recovered from vertigo by the establishment of compensatory mechanisms rather than by restoration of labyrinthine function. Deafness occurred in 2 of the 16 patients, a surprisingly low proportion in view of the high doses of streptomycin dispensed (3 gm. daily for 120 days).

Stevenson, Alvord, and Correll[35] were among the first to study the morphological damage caused by streptomycin, observing a liquefaction necrosis of neurons in the ventral cochlear nuclei in five patients and involvement of the inferior vestibular nuclei in one case correlated with a clinical history of deafness following streptomycin therapy. Animal experimentation resulted in similar observations. Three dogs showed muscular weakness and lack of coordination. Histological examination again showed liquefaction of neurons bilaterally in the ventral cochlear nuclei.

Chase[36] was one of the first to study on a larger scale the effects of streptomycin on the eighth nerve. He performed audiometric studies on 150 patients before, during, and after treatment with streptomycin. Eighteen patients showed a slight decrease in hearing, in favorable contrast to the vestibular function, which seemed more readily affected. A group of 18 patients receiving 2 gm. of streptomycin daily for 90 days showed loss of vestibular response in 15; in a group of 26 receiving 1 gm. daily, only 3 patients lost the caloric response during treatment and 7 after

termination of treatment, while 16 maintained a normal reaction throughout. Ten patients receiving 0.5 gm. daily showed no loss of caloric response, as did 18 receiving 0.2 gm. daily by aerosol inhalation.

Tabulation of vestibular symptoms like vertigo, ataxia, and dizziness comprised the group of 35 patients taking 2 gm. or more of streptomycin for 90 days; of these, 10 showed disturbance after the second month, another 10 after the third month of medication. Most patients eventually learned to compensate for the loss of vestibular function, being able to walk with their eyes closed or in the dark.

Nielsen and Marsh [37] published a neurological study of toxic streptomycin reactions in four cases, calling attention to loss of vestibular function, the subsequent dependence on vision for balance, and the loss of coordination between the extraocular and neck muscles used in the tonic neck reflexes, thereby localizing the specific lesion in the fasciculus longitudinalis medialis. The hearing loss in these cases was only slight. In a fifth case, which came to autopsy after streptomycin-resistant tuberculous meningitis, histological section of the brain stem at the level of the cochlear and vestibular nuclei showed cellular destruction, chromatolysis, pigmentary atrophy, some demyelinization, and, again, slight involvement of the fasciculus longitudinalis medialis.

One of the most unusual complications during streptomycin therapy was described by Beham and Perr,[38] who observed a painful erosive membranous stomatitis in three patients, involving the oral mucosa and the undersurface of the tongue. These oral lesions disappeared promptly within two weeks after cessation of drug therapy and just as readily reappeared after streptomycin injections were resumed. In view of the small number of cases observed, the authors felt reluctant to correlate the occurrence of the stomatitis with the dosage and duration of treatment.

Fowler,[39] discussing the effects of streptomycin on the otic mechanism, stressed that the effects of the drug were limited, because the drug inhibited the growth of the tubercle bacillus without permanently arresting its growth. He felt that the drug itself, not the impurities caused in the manufacture of the antibiotic, was responsible for a slight reaction, like deafness and vertigo. He confirmed that the dosage and length of medication are decisive factors among the causes for toxic reactions, observing that 2 to 3 gm. daily usually produce contrary effects after 28 to 29 days of treatment. In a group of 160 patients treated for 10 to 14 days, only 3 showed dizziness and 1 developed deafness, while in a comparative group of 23 treated for three months with high daily doses, 20 cases showed vertigo and 1 deafness.

In Switzerland, Montandon and Camenisch [40] examined cochlear and vestibular function in 10 patients, whose ages ranged from 11 to 32 years. They were treated for pulmonary and meningeal tuberculosis, receiving during the first week 3 gm. of streptomycin daily and then 1.5 to 2 gm., in addition to 0.1 to 0.25 gm. intrathecally in four patients. Like Fowler, the authors emphasized the relation between drug dosage and intensity of vestibular disturbance, and the specific neurotoxic effect on the vestibular nerve and, less markedly, on the cochlear nerve. They considered a daily dose of 3 gm. to be near the toxic limit and that 3.25 gm. given intrathecally presented an even greater risk.

Tompsett [41] studied the relation between streptomycin dosage and toxic reactions of the patient. The author criticizes the early therapeutic trials with too high doses

of streptomycin and too frequent injections (every three to four hours). Recent studies of serum concentration during streptomycin therapy show that the dosage should be in proportion to the body weight of the patient and that longer intervals between injections are permissible.

The impairment of hearing and the duration of vestibular disturbance are largely dependent upon the dosage (3 gm. or more daily), but it is felt that poor renal function represents a precipitating factor in the development of otic complications. Furthermore, it was demonstrated that the intrathecal administration of streptomycin in cases of tuberculous meningitis is more liable to cause drug reactions. And, finally, there was a group of cases with drug anaphylaxis and hypersensitivity, with temporary symptoms, such as fever, asthma, skin eruption, and eosinophilia; in five such cases streptomycin was replaced with dihydrostreptomycin, which has antibiotic qualities equal to those of streptomycin sulfate but apparently is less toxic.

Snell [42] gives a brief discussion of the toxic symptoms deriving from an overdose of streptomycin, such as vertigo, tinnitus, impaired hearing, blurred vision, eosinophilia, perioral pruritus, dermatitis, angioneurotic edema, and albuminuria. After the initiation of streptomycin therapy with a daily dosage of 2 to 4 gm., such complications usually occur between the 14th and the 40th day, with their highest frequency between the 30th and the 35th day of treatment. After the daily dose was reduced to 1 gm. daily, otic complications occurred much later, if at all. The article concludes with a summary of the St. Louis Streptomycin Conference in May, 1947, stating that among 809 patients receiving 2 gm. of streptomycin daily for 120 days 96% had subjective and objective symptoms of toxicity. Streptomycin therapy was discontinued in 34 cases (4%) for the following reasons:

Renal damage	12 cases
Partial deafness	8 cases
Exfoliative dermatitis	10 cases
Neutropenia	2 cases
Psychosis	1 case
Hepatitis	1 case

In a paper on local and systemic reactions during streptomycin therapy, Wiener and Lederman [43] discuss dosage and clinical complications, reiterating the observations of Hirschfield and Farrington. They report the following case:

A 58-year-old man with a history of pulmonary tuberculosis of almost 20 years' duration suffered of considerable cough and expectoration, evidently based on extensive bronchiectasis. A trial with penicillin to clean up the secondary bacillary flora showed that he was allergic to the drug when he suffered an attack of asthma and facial edema. Bacteriological examination of the sputum revealed a hemolytic Streptococcus and a Streptococcus of the viridans group, both sensitive to streptomycin. In view of the allergic manifestation, the patient was skin tested for streptomycin for two days, and, as no undue reaction took place, he received streptomycin by aerosol inhalation (1 cc. of solution every three hours). Cough and expectoration decreased markedly during the following days, the sputum thinned out and lost its foul odor, and there was general improvement in the patient's clinical condition. On the ninth day, the patient became very dyspneic and the drug was discontinued. During that night the patient suffered a severe attack of asthma and showed a definite flare-up at the sight of the skin testing, with reddening, swelling, and tenderness.

A study of streptomycin literature shows that the onset of allergic manifestations on the ninth day is fairly typical and that this period therefore deserves particular alertness.

Graf,[44] in Switzerland, made a substantial investigation of vestibular and cochlear damage caused by streptomycin, which is too extensive for detailed abstraction. It contains general comments on various drugs and toxins damaging the eighth nerve and clinical observations on cochlear and vestibular disturbances from streptomycin, with an analysis of his case material, which is composed of 41 patients (adults and children) suffering of pulmonary and meningeal tuberculosis. The study is supplemented with histological findings on cochlear and vestibular nerves damaged by streptomycin. Clinically, high doses of streptomycin affected the vestibular apparatus more readily and more frequently than the cochlear nerve, which seemed less sensitive to the drug. Four grams of streptomycin daily abolished vestibular function in two to three weeks and effected definite auditory impairment, while 3 gm. caused considerable decrease of the vestibular response but rarely decreased the hearing seriously. One to 1.5 gm. per day was considered to be safe for both vestibular and auditory functions. The toxic effect of the drug is cumulative, because the symptoms increase for a few days even after medication was discontinued. Vestibular defect was permanent in the majority of the cases but was repaired by compensatory mechanisms.

The author corroborated the findings of other clinicians, confirming that deafness was more readily caused by intrathecal administration in seven cases of tuberculous meningitis.

Guillon [45] presented a patient of casuistic interest at an otolaryngological clinical session. A 25-year-old woman with far advanced pulmonary tuberculosis and extensive ulceration of the larynx was treated with streptomycin. Three weeks after institution of treatment she developed dysphagia, caused by a supraglottic stenosis, reducing the laryngeal opening to a 5 to 6 mm. cleft. This complication demonstrated the fast cicatrization of a laryngeal lesion under streptomycin therapy.

Another case history was published by Lundgren,[46] who observed after two weeks of streptomycin therapy vertigo and loss of hearing, while the vestibular response was still normal. Upon continuation of the drug the caloric reaction and rotatory response disappeared; six weeks after streptomycin was discontinued the rotatory response returned to normal, while the caloric reaction was still absent at the time of publication.

A third case history was added by Gundrum,[47] who observed paralysis of the left vocal cord following streptomycin therapy in a 33-year-old woman operated on for renal ptosis. About two weeks after surgical suspension of the right kidney, she received 11 gm. of streptomycin over a period of one week; two weeks later the patient complained of a lump in her throat, difficulty in swallowing liquids, and some hoarseness. On examination the author found complete paralysis of the left vocal cord and impaired hearing, while the vestibular function remained normal.

Sirota and Jones [48] studied the effects of streptomycin on the cochlear and vestibular mechanisms in 16 patients with renal tuberculosis receiving 1.8 gm. of streptomycin daily in divided doses of 0.3 gm. every four hours for 120 days. Audiograms for air and bone conduction and caloric tests were done every week throughout treatment and for a follow-up period of three months after cessation of medication. Clinical findings were the following: Tinnitus in 4 patients; diminished hearing in 2 (1 of whom recovered); transient nausea in 10; dizziness occurring between the 10th and 22nd days in 15, in 13 of whom it persisted for from 6 to 11

months; absence of caloric response in 15 (the response returning to normal in 9 after 1 to 6 months). On the ground of these observations the authors recommended modification of the dosage schedule to 1 gm. daily for 42 days.

PARAAMINOSALICYLIC ACID (PAS)

Paraaminosalicylic acid (PAS) gained an important place in the treatment of tuberculosis during the postwar years, and numerous papers on it can be found in the Scandinavian and Central European literature. One of the first references on the use of PAS in tuberculosis of the upper respiratory tract was contained in a letter written by Seiler [49] to the *Tubercle*, the British monthly, reporting on a trip to Switzerland and remarking on the extensive use of the drug for all forms of tuberculosis, including tuberculous laryngitis, lymphadenopathy, and otitis media. The dosage ranged from 10 to 20 gm. of PAS daily in divided doses, including application of a 20% solution given topically for otitis media and intravenous injection of a 20% solution in laryngeal cases; relief of dysphagia was effected as early as three days after institution of treatment.

Amsler, Varlet, and Habert [50] presented the case of a 9-year-old girl with miliary tuberculosis and ulceration of the tonsils, soft palate, and arytenoids and miliary granulations covering the vocal cords and ventricular bands. The child was highly toxic, suffering of dysphagia and anorexia. A therapeutic trial with streptomycin failed to show any success. When the general condition deteriorated and signs of incipient meningitis set in, the patient received 12 gm. of PAS daily, most of which was given intravenously because of persistent vomiting, up to a total of 159 gm. in addition to a total of 80 gm. of streptomycin. After two weeks the meningeal symptoms disappeared, there was marked pulmonary clearing on x-ray, and the pharyngolaryngeal lesions healed with considerable cicatrization, unfortunately, and with stenosis of the larynx, which jeopardized the prognosis. This case report is among the first to recognize that PAS enhances the effects of streptomycin, an observation which was later confirmed by extensive studies done in Veterans Administration hospitals.

Two cases of tuberculous otitis media correlated with renal and intestinal lesions subsequent to far advanced pulmonary tuberculosis were treated with PAS by Smars and Kemp.[51] The otitis media showed remarkable clearing, and the general state of both patients improved so much that they could be discharged from institutional care. Both cases would have had a most unfavorable prognosis previous to the streptomycin and PAS era.

A similar observation was published by di Fonzo and Pellegrino,[52] who treated two cases of laryngeal tuberculosis with PAS and reported satisfactory topical and systemic improvement.

Five cases of pulmonary tuberculosis with oral and pharyngolaryngeal ulcerations were treated by Salvi [53] with 20% PAS aerosol, which effected healing of the ulcers in three cases.

A larger group was observed by Nielsen and Vallentin,[54] who used PAS on 15 patients with pulmonary and laryngeal tuberculosis. Thirteen patients received PAS as a primary therapeutic trial, while two were treated previously and unsuccessfully with paraacetylaminobenzaldehyde thiosemicarbazone (Tibione). In addi-

tion to PAS, collapse therapy was added as indicated. The patients received 12 to 14 gm. PAS daily by mouth and 2 gm. by inhalation for 3 to 10 months. The results were very gratifying in 11 of the 13 patients mentioned above.

In Italy, Cristiani and Pifferi [55] made a comparative study on the use of PAS and combined streptomycin and PAS in a series of 24 cases. The therapeutic results were identical in the two groups, a conclusion with which we feel most American authors would not agree, giving preference to combined therapy rather than relying on PAS alone. The authors noted that the more recent the laryngeal lesion, the prompter the therapeutic response, especially in infiltrative types. Trials with PAS aerosol inhalation were encouraging. On the whole, it was found that laryngeal lesions responded better than the basic pulmonary process.

One of the more extensive surveys on chemotherapy in laryngeal tuberculosis was done by Wallner and his collaborators,[56] who studied 70 cases out of a group of 124 treated with streptomycin and/or PAS. The dosage varied during the study; an early group of patients received 2 gm. of streptomycin daily for 120 days. Later on, the dose was reduced to 1 gm. and finally to 0.5 gm. a day for 60 days. At the time of publication, doses of 0.75 gm. for 60 days were agreed upon. PAS was given in the amount of 12 gm. daily for 120 days.

Among the 70 patients who were studied before, during, and after drug therapy, 39 complained of dysphagia, which was relieved in all cases, with the exception of 2. The symptomatic relief usually began within four to seven days after the institution of therapy. Hoarseness was noted in 65 patients and was improved in all but 6, with marked to complete disappearance of the symptom in 41 cases. The objective results were tabulated as follows:

Treated with streptomycin and/or PAS	70
Markedly improved or healed	37
Moderately improved	23
Slightly improved	5
Unchanged	2
Worse	3

Progress was most evident in tuberculous ulcerations and granulations, less impressive in infiltrations and hyperemia. There was no correlation between the pulmonary and laryngeal improvement, which often continued after cessation of drug therapy. A second course of streptomycin never seemed as effective as the first. No topical treatment of the larynx was given, but strict silence was enjoined, and the patients were forbidden to smoke.

The value of streptomycin with and without PAS was stressed because of its palliative effect in the relief of pain in cases in which previous curative results did not come up to expectation.

Morris and Prosser-Evans [57] studied the effect of PAS in tuberculous lymphadenopathy. The survey comprises a clinical investigation of 372 cases with tuberculous cervical lymph nodes, observed over a period of 10 years and treated as follows:

Curettage	181
Aspiration and ultraviolet radiation	75
Aspiration and instillation of glucosulfone sodium (Promanide)	65
Aspiration and instillation of sodium PAS	51

It is the fourth group with which we are particularly concerned. The caseated nodes were aspirated, and then 1 ml. of 20% of sodium PAS solution was instilled. The treatment was repeated at weekly intervals until the formation of pus ceased and the contents of the abscess cavity became serous.

The authors claim excellent therapeutic results, which were also cosmetically gratifying because there remained little residual scarring of the sinus tracts and ulcerations. The skin above the glandular abscess was usually intact after healing, which was considerably accelerated by PAS, as compared with the older, more time-consuming therapeutic methods.

PARAACETYLAMINOBENZALDEHYDE THIOSEMICARBAZONE (TIBIONE)

In addition to streptomycin and PAS, which represent the most important contributions in the treatment of tuberculosis since the end of World War II, there are a host of other chemotherapeutic agents and antibiotics, tried both experimentally and clinically. Of special interest is isoniazid, which has been used extensively during the last two years, but, as far as its use in the field of upper respiratory tuberculosis is concerned, there still is an insufficient amount of published material. The effects of the drug, therefore, will have to be discussed at some future date.

Finally, we should like to add a few references on paraacetylaminobenzaldehyde thiosemicarbazone (Tibione), which was developed in Germany but failed to live up to expectations of the early and perhaps too promising forecasts.

Stutz [58] gives an appraisal of Tibione in the treatment of laryngeal tuberculosis based on observations of 41 patients who received 25 to 50 mg. daily during a period of 18 months in a German tuberculosis sanatorium. Pain and dysphagia were relieved frequently, sometimes within four to five days after the institution of treatment, and the symptomatic improvement was followed by better nutrition and better general physical condition. The speed of the structural healing, depending upon the extent of tuberculous involvement, ranged from five days to four weeks in mild cases and from two to eight weeks in the moderately advanced group.

Of a total of 41 patients, 32 (78%) were considered to be cured. The article includes a discussion of numerous toxic reactions, such as agranulocytosis, exanthema, emesis, loss of weight, conjunctivitis, increased urobilinogen, anemia, urticaria, stomatitis, and vulvitis.

A follow-up study by Stutz [59] should be of academic interest, but, unfortunately, we were unable to secure a copy.

Any reader interested in Tibione will find additional information in the *American Review of Tuberculosis* of January, 1950, in which Behnisch, Mietzsch, and Schmidt [60] cover the chemical structure of the thiosemicarbazones, and Domagk,[61] who developed the drug, comments on the antituberculous activity of Tibione. Mertens and Bunge,[62] co-workers of Domagk, give an account of the clinical results with Conteben (Tibione).

We limit ourselves to the results in laryngeal tuberculosis which more or less corroborate the observation of Stutz. The authors stress the prompt symptomatic responses, such as relief of dysphagia, decrease of secretion and edema, and satisfactory regeneration of mucosal lesions. Cases with extensive destruction of cartilage healed well, with scar formation.

It was necessary to continue the drug therapy for several months beyond symptomatic improvement, to prevent relapse. In addition to systemic application, Conteben was given topically by spray of a fine dusting powder. The dosage started with small initial doses, of 12.5 to 25 mg. daily, and was increased gradually and slowly according to the individual needs, therapeutic response, and tolerance of the patient. The average maintenance dose was calculated on the basis of 2 mg. for each kilogram of body weight; in general, 200 mg. per day was sufficient, making exception for a few patients who received a maximum of 300 mg. The toxic reactions included the complications mentioned by Stutz in addition to leucopenia, hypoglycemia, encephalopathy (headaches and signs of increased intracranial pressure), and liver damage. It was particularly the toxic effect on hepatic cells, emphasized by American scientists, which prevented the drug from ever becoming popular in this country.

TUBERCULOSIS OF THE MOUTH

Miescher [63] presented a case of tuberculosis of the oral mucosa before a session of dermatologists in Zurich, Switzerland, which is of academic interest, because it shows complete absence of a primary process in the lungs. The patient was an 11-year-old girl, who suffered from pain of the right upper gums on mastication and fever. Examination revealed granulation tissue of the gingiva above the right upper molar and on the palate. The Mantoux reaction was positive, and the tuberculous nature of the proliferation was proved by histological examinations.

Similar observations were made by Piaget,[64] who described three cases of primary tuberculosis of the pharynx, all confirmed by biopsy, with normal chest films and repeatedly negative sputum. The patients were three youngsters suffering from recurrent sore throat, with cryptic tonsils and tuberculous ulcerations extending from the tonsils over the posterior pillars into the pharynx.

Coté [65] describes two cases of pharyngolaryngeal miliary tuberculosis seen at Laval Hospital in Quebec, Canada, and comments on the frequency and clinical picture of Isambert's syndrome in miliary tuberculosis. This paper reiterates previous descriptions, and, as the clinical observation was made during the pre-streptomycin era, it is of little interest today.

Rienks,[66] a member of the Dermatology Department of Groningen University, Netherlands, discussed the treatment of lupus of the palate. In addition to the old therapeutic standbys, such as bed rest, a diet high in calories and vitamins, and ultraviolet radiation, he draws attention to the method advocated by Neuber, using injections of gold, convalescent serum, and autohemotherapy. The old treatment with lactic acid, diathermy, and excochleation has now been replaced by superficial x-ray therapy. The cases are described in detail, all showing satisfactory results.

Ott,[67] in a treatise on etiology and therapy of oral ulcerations, describes the differentiation between syphilitic and tuberculous lesions in addition to ulcerative stomatitis caused by Plaut-Vincent's spirilla and Fusobacteria. The substance of the paper, written primarily for dentists, should be most familiar to both the otolaryngologist and the phthisiologist.

One of the more extensive studies on pharyngeal tuberculosis comes from Capo Cisneros,[68] who gives a summary of two years on a laryngological service comprising the impressive number of 2,500 patients, among whom he found 55 with pharyngeal tuberculosis.

At onset there was usually a localized area of hyperemia of the mucosa, which was slightly elevated, with round and rather regular margins and of a glossy and brilliantly purple appearance; these initial lesions later developed into infiltrations, ulcerations, or hyperplasias. The lesions were localized, in order of frequency, at the posterior pharyngeal wall, tonsils, posterior pillars, anterior pillars, lateral hypopharynx, soft palate, and, finally, the lingual tonsil. Pathologically, the 55 cases were tabulated as follows:

Ulcerations	14
Infiltrations	29
Ulcerative-infiltrative formations	8
Granulations	2
Ulcerogranulative formations	2

Forty-nine patients had associated tuberculosis of the larynx and 14 intestinal tuberculosis.

In the majority of cases the pharyngeal process was based on extensive biteral fibrocaseous tuberculosis of the lungs with cavity formation. The author felt that the clinical course varied according to the localization of the lesion. It progresses faster in ulcerative involvement of the tonsils and pillars. Prognosis was generally poor; 17 of the 55 patients were dead at the time of publication. Twenty short case histories conclude the study.

Brodsky [69] discusses a few problems of interest to the dentist treating institutionalized tuberculous patients. First he comments on the problem of exposure for the dentist working in a tuberculosis sanatorium; even after the dentist handled patients with far advanced pulmonary disease and a high Gaffky count, it was impossible to recover tubercle bacilli from the facial gauze mask, which therefore should be considered adequate protection. Nonspecific findings, such as dental caries and gingivitis, do not occur more frequently or more extensively in tuberculosis. Oral tuberculosis nowadays is an infrequent complication, but when it occurs it still occasionally passes unrecognized. It is easily diagnosed in cases with far advanced systemic tuberculosis spread by the hematogenous route. The oral mucosa is quite resistant to direct implantation of the tubercle bacilli; a high Gaffky count therefore has comparatively little significance as an etiological factor. The common mucosal lesions of oral tuberculosis are described, such as ulcers, tuberculomata, granulations, fissures, papilloma, and chancres. The commonest localization is the tongue; then, in order of frequency, the lips, inner cheek, oropharynx, palate, and the floor of the mouth. Therapeutically, startling results are claimed with the application of grenz rays, a special tube designed in collaboration with Dr. Bucky, being used. The surgical excision of the ulcers is unsuccessful, and the lesions recur. Tuberculous abscesses are treated by incision and drainage.

Nattino,[70] of the Tuberculosis Institute at Montevideo, Uruguay, found a 38% incidence of pharyngolaryngeal tuberculosis, which is high in comparison with North American statistics; the high incidence may possibly be explained by inferior hygienic standards. The clinical and therapeutic comments on oral tuberculosis are conventional and fail to add anything new to the existing literature. Eleven photographs of oral tuberculous lesions illustrate the paper.

Lupus of the palate is usually secondary to nasal and facial lupus. Primary involvement, which is denied by some authors, is described by Ricci,[71] who observed four cases. The initial lesion is usually located at the soft palate and uvula and passes from the infiltrative stage into proliferation or ulceration. The subjective symptoms are scanty, even in cases with extensive involvement. The lesions are treated with galvanocauterization and diathermy coagulation; relapses are fairly frequent, and the patient therefore should be checked at frequent intervals.

Retropharyngeal abscesses, which are seen not infrequently in pediatric practice, may derive from any suppuration in the inferior retropharyngeal lymph nodes after infections in the nasopharynx and the cervical spine. A cold abscess may originate from tuberculous cervical glands, and often causes few symptoms except dysphagia (Brügger[72]).

TUBERCULOSIS OF THE TONGUE

De Souza Dias and da Silveira[73] give a clinical discussion of tuberculosis of the tongue, describing the etiology and the clinical picture correlated with the pathology, anatomy, diagnosis, prognosis, and treatment. Two case histories are added. One patient died, and the tuberculous nature of the lingual ulcer was confirmed by autopsy; the second patient was cured by galvanocautery. The paper, which contains a rather extensive bibliography, is an academic repetition of the usual textbook information and of little interest to the informed specialist.

Steinberg, Mengoni, and Viglino[74] add to the case materials by describing the clinical history of a 52-year-old man with bilateral exudative tuberculosis, with cavity formation, positive sputum, and an E.S.R. of 80. He presented an ulcer at the dorsal anterior third of the tongue, which gradually increased in size, causing considerable pain; the submaxillary glands were enlarged, hard, and indolent. The patient was treated with vitamin B, nicotinic acid, and gold. Lingual spread of tuberculosis by the hematogenous and lymphatic routes and by continuity is possible, but in practice it is often difficult to decide which of the three passageways was chosen. A short literary survey of lingual tuberculosis is added to the study.

The symptom of glossodynia was discussed by Bajer,[75] who in his case material of patients with pulmonary tuberculosis found 22 men complaining of pain and a burning sensation of the tongue, especially during ingestion of sour and spicy foods. Symptomatic relief was often obtained by ergotamine tatrate (Gynergen) given before mealtime.

Shamaskin[76] published his results of streptomycin treatment in three cases of tuberculosis of the tongue. The patients received 2 gm. of streptomycin daily for 60 to 120 days. The tuberculous ulcers healed in one case and improved and relapsed in the second case; the third case did not show any structural healing at all. The author surmises that the effect of streptomycin depends, among other factors, on the age of the lesion, i. e., the older and more fibrotic the lesion, the more resistant it is to antibiotic therapy.

Finally, Wolfer, Hirshleifer, and Shapiro[77] describe the case of a 49-year-old man with a recalcitrant ulcer of the tongue of more than seven months' duration. The patient had a history of active pulmonary tuberculosis 16 years previous to the appearance of the lingual ulcer, which was found to be tuberculous on biopsy. He was treated with streptomycin, 1 gm. daily, up to a total of 75 gm. After 10 days the lingual ulcer showed definite improvement and after 10 weeks complete

epithelization. The chest film revealed bilateral caseous tuberculosis throughout both upper lobes, with multiple cavities. In contrast to the ulcer of the tongue, the pulmonary lesions did not show any change after treatment with streptomycin.

TUBERCULOSIS OF THE TONSILS

One of the most valuable studies among the few original papers on the pathology of tuberculosis of the upper respiratory tract was contributed by Ellonen,[78] whose article on the relation between tuberculosis of the tonsils and tuberculous osteoarthritis in children is too extensive to lend itself to abstracting. The first part of the 129-page monograph is concerned with considerations of tuberculosis of the tonsils, bones and joints, including the primary port of entry of the tubercle basilli, invasion of the tonsils, dissemination of the tonsillar process, and development of tuberculosis in bones and joints, with extensive comments on frequency, clinical course, treatment, and morbid anatomy of tuberculosis of the tonsils. Part 2 comprises the clinical study by the author, who examined the tonsils of 104 children, of whom 74 had tuberculosis of the bones and joints, while the remaining 30 were apparently healthy.

Among the 74 cases of osteoarthritis, 20 (27%) showed tuberculous lesions of the tonsils. These 20 case histories are described in detail along with the method of treatment and the histological and bacteriological findings of the survey.

In conclusion, Ellonen stresses the importance of the tonsils as a port of entry for tuberculous infection and their significance as a primary focus for subsequent bone and joint tuberculosis. In apparently healthy children the frequently encountered hypertrophic tonsils harbor tubercle bacilli only very rarely. Tonsillectomy is advised in tuberculin-positive children with a tendency toward adenoid vegetations and recurrent throat infections. Biopsy and histological examinations are recommended for suspects. Finally, enucleation of hypertrophic or abscessed tonsils is recommended in children with tuberculous osteoarthritis, provided the general physical condition warrants it.

In a follow-up study Ellonen[79] examined the tonsils of 67 children (in the age groups of 1 to 3 years and 8 to 10 years) with tuberculosis of the bones and joints. Seventeen cases (about 25%) gave evidence of primary tuberculous lesions in the tonsils. Angina, measles, whooping cough, and pneumonia apparently are contributing factors to the tonsillar invasion by tubercle bacilli, and from the primary focus the infection then spreads by the hematogenous route to the skeletal system. Both papers should be of great interest not only to the laryngologist and phthisiologist but also to the pediatrician and pathologist, and they are well worth being studied in their original version.

Garcia Ibanez[80] describes a case in which a 4-year-old boy was referred for tonsillectomy. On initial examination the child presented hypertrophic infected tonsils, with enlargement of the cervical lymph nodes and an indurated soft palate of almost cartilaginous consistency. Surgery had to be postponed because of persistent fever, cough, dysphagia, and anorexia. The general condition continued to deteriorate until, in addition to the symptoms mentioned, there appeared an irregular ulcer with a granular base in the right tonsil, which proved to be tuberculous on biopsy. The chest x-ray failed to reveal any evidence of pulmonary tuberculosis, and, therefore, the author classifies this case as rare primary tuberculosis of the tonsils. After a septic course the infection terminated in death.

The problem of tonsillectomy in tuberculous patients has been commented upon frequently, and Prat-Rousseau [81] adds an extensive treatise on the subject supplemented by a comprehensive and up-to-date bibliography. In this era of antibiotic coverage of tuberculosis, his contraindications for tonsillectomy seem rather severe: excluding from surgery the patient with primary or secondary tuberculosis of the tonsils. For the patient with active tuberculosis and hypertrophic tonsillitis, he advises tonsillectomy only with great reservations, which, however, might be waived if the tuberculous process is of low virulence and shows good scar formation with old and stable lesions.

While the clinical conclusions of this paper are outdated, in view of the therapeutic advancement of the postwar years, we feel that the paper is a valuable literary contribution.

Diez,[82] a little more liberal, advocates tonsillectomy for tuberculosis patients with both unspecific and tuberculous pathology, provided their pulmonary process is stabilized and the general physical condition satisfactory.

Gadolin [83] presents four cases of acute, and probably primary, tuberculosis of the tonsils in young soldiers, between the ages of 21 and 30; all died after a rapid septic course of 6 to 12 weeks' duration. The tonsillar ulcerations usually involved the pillars and extended to the soft palate and pharynx, followed by caseation and necrosis, causing pain, dysphagia, and malnutrition. From the primary tonsillar focus the infection first spread to the regional lymph nodes and then by hematogenous miliary dissemination to the lungs, in three out of four cases. The author advises early resection of tonsils, as soon as the tuberculous nature of the ulceration is recognized.

Schlitter [84] surveys the literature on primary tuberculosis of the tonsils and points out that the disease occurs more frequently than formerly assumed, particularly in children without any demonstrable pulmonary lesions and without calcified hilar nodes. In these cases the tonsils might present the port of entry for tuberculous cervical adenitis or tuberculous infection of the joints and bones. For this reason the desirability of early tonsillectomy is stressed. The author performed tonsillectomies on 98 children, and histological examination of the specimens revealed tuberculous lesions in 48 cases.

Three cases are described to illustrate the author's views; the children who presented submaxillary adenopathy were tonsillectomized, and biopsy of the cervical specimens revealed tuberculous foci. After the tonsillectomy, all cases showed regression of the enlarged lymph nodes and prompt clinical healing.

Martens' [85] presentation of surgical material represents a perfect complement to the preceding study. Among 387 children with pulmonary or extrapulmonary tuberculosis, he performed 85 tonsillectomies for hypertrophic tonsillitis and adenoids obstructing free ventilation or giving rise to recurrent upper respiratory infections and jeopardizing the child's general physical condition. Another indicaton was the discrepancy between satisfactory regression of the pulmonary process and poor general health, with a persisting high white cell count, high sedimentation rate, and failure to gain weight, pointing toward the presence of an acute extrapulmonary focus of infection.

The histological examination of the operative specimens revealed tuberculosis in 27 patients, 10 of whom had pulmonary tuberculosis, while the remaining 17 had

tuberculous osteoarthritis or adenopathy. A description of the operative technique, postoperative complications, and convalescent care and the detailed histories of two cases of primary tuberculosis of the tonsils conclude the article.

Taillens [86] presents an academic discussion of tuberculosis of the tonsils, describing the various pathological forms, clinical picture, etc. It is a sound, well-organized presentation, which would fit well into a basic otorhinolaryngological textbook but has little to offer the specialist. There are 23 references.

In a lecture delivered before the Swiss Society of Otolaryngology, Taillens[87] gave a clinical presentation of tuberculous tonsillitis, including a systematic arrangement of the various lesions, based on the traditional classification by Ranke:

Stage I: Inoculation chancre of the mouth, tonsils, and pharynx

Stage II: Dissemination by continuity or by the lymphogenous, hematogenous, or canalicular route

1. Acute and subacute miliary tuberculosis, sometimes with extensive ulceration
2. Tuberculosis of Waldeyer's lymphatic ring
   (*a*) Benign hyperplastic tuberculosis of the tonsils
   (*b*) Tuberculous tonsillitis

Stage III: Chronic ulcerative tuberculosis with caseation or granulation

Vetter [88] debates the importance of the tonsils as a focus of infection for specific nephritis, rheumatic fever, tuberculous osteoarthritis, and scrofula in children. His work supports the thesis of Ellonen.[78]

Manci [89] gives the case history of a 56-year-old woman suffering from an apparently primary tuberculosis of the tonsils. Examination of the respiratory tract was essentially normal; the chest roentgenogram gave no evidence of active or quiescent tuberculosis, with the exception of bilateral calcified perihilar nodes. The necessity of biopsy in the diagnosis of primary tonsillar tuberculosis is stressed.

Wegelin [90] gives as an introduction to his article a classification of tonsillar tuberculosis, as follows:

1. Primary tuberculosis of tonsils (by ingestion in infants, inhalation, or inoculation)
2. Secondary tuberculosis
   a. Through hematogenous dissemination from an extratonsillar focus
   b. Through exogenous superinfection
   c. Through retrograde lymphogenous infection
   d. Through inoculation of tubercle bacilli from an open pulmonary lesion (sputogenous)

After discussing primary tuberculosis in infancy and childhood and the routes of infection, the author presents his own material consisting of 23 cases of acute and subacute miliary tuberculosis; 17 of these showed tuberculous lesions in the tonsils, 2 of which were apparently cases of primary tonsillar tuberculosis, judging from histological examination and autopsy. The conclusion is drawn that in generalized miliary tuberculosis the tonsils were frequently involved. Typical tubercles were found in subepithelial and lymphatic tissue. Chronic latent tuberculosis of the tonsils is frequently of hematogenous origin, especially in the presence of open pulmonary lesions and hilar tuberculosis. The possibility of exogenous superinfection of the tonsils should be considered more frequently than has been done so far in the literature.

Landgraf,[91] of Lausanne, Switzerland, presents a statistical evaluation of his case material on 448 children between the ages of 3 and 15 years, who underwent tonsillectomies, adenoidectomies, or both (689 operations in toto). The tuberculous lesion in surgical specimens was confirmed on histological examination in 13.3% of lymphoid tissue specimens and in a somewhat higher incidence in hypertrophic tonsils. Surgery was well tolerated, as a rule. Tuberculosis of Waldeyer's ring usually occurs by hematogenous spread, but blood-stream dissemination beyond the lymphatic barrier is comparatively rare.

De Mumbert[92] collected only nine cases of tonsillar tuberculosis among 40,000 tuberculosis patients, which shows quite a discrepancy from the results of the Swiss clinicians mentioned above, whose findings were based on serial histological examinations of their case material, and whose figures therefore probably come nearer to the true average.

Thiers[93] maintains that in cases of lupus of the face and neck the tonsils have to be considered as a possible start of the tuberculous pathway. Some of these patients present also tuberculous cervical adenopathy; these cases should first be treated according to the method of Charpy, and if this method does not give the desired results tonsillectomy should be performed to eliminate the primary focus of infection. Three cases thus managed by the author showed gratifying results.

Halasz[94] presents a 70-year-old patient with tuberculosis of the left tonsil, who received 1 gm. of streptomycin daily, injected into the peritonsillar tissue, preliminary to a tonsillectomy performed with use of local anesthesia. The patient underwent an uneventful postoperative convalescence, and the follow-up examination seven months after surgery showed the patient to be in good condition, without any evidence of residual extrapulmonary tuberculosis.

TUBERCULOSIS OF THE CERVICAL GLANDS

Kaiser[95] advocates the surgical attack on cervical lymphadenitis in preference to conservative treatment, which even after months or years of curing does not always give satisfactory and permanent results. Also, x-ray irradiation of the tuberculous glands is not always successful and might result in abscess formation, with the necessity of repeated punctures, incisions, or enucleation, and may result in the formation of a draining sinus.

He operated on 25 patients, whom he followed closely, with the exception of 1. The discussion covers the age group, length and course of the disease, surgical technique, hospitalization, and the postoperative complications. Twenty-one of the 24 patients were considered to be cured after resection of the glands. Two cases developed contralateral infection, which also had to be surgically remedied; there were no serious postoperative complications, most of the incisions healing well with cosmetically satisfactory scars. The average stay in the hospital was 11 days; postoperatively, one case was treated by radiation from a quartz lamp. Four patients were sent for several months to mountain resorts for recuperation, and one required lengthy sanatorium rest, because of coexisting spondylitis.

Among the indications for resection, the author lists failure of conservative measures, localized lymphomata of long duration, tuberculous lymphadenitis in patients with a good general physical condition and without any active systemic

tuberculosis who either are unable to afford sanatorium rest or have already tried it unsuccessfully, and, finally, selected cases in which x-ray irradiation is either refused or contraindicated.

An interesting combination of tuberculous adenitis and iritis is reported by Fleming,[96] who saw a 25-year-old Bantu woman presenting submaxillary adenitis and right facial paralysis, and who was blinded for two years by an extensive plastic iritis. X-ray studies of the chest and bones failed to reveal any systemic tuberculosis. Biopsy of the lymph nodes and guinea pig inoculation confirmed the tuberculous etiology.

An impressive series is presented by Osipov and Soboleva,[97] who observed 380 patients with tuberculous lymphadenitis over a period of nine years in a sanatorium. A sizable number of the patients were treated by heliotherapy combined with ultraviolet irradiation in 30 to 40 sessions, starting at 5 minutes and building up to 50 to 60 minutes, a method which proved successful in 62%.

The contraindications for irradiation were periods of exacerbation, the presence of active pulmonary or perihilar infiltration, marked enlargement of the hilar and peritracheal lymph nodes, suggestion of caseation, and, finally, general involvement of the lymphatic system, marked toxemia, renal tuberculosis, and amyloidosis. The hyperplastic, caseous, and fibrocaseous forms were frequently treated with tuberculin, which caused healing in 58.3%, improvement in 28.9%, no change in 10%, and deterioration in 2.8%. Tuberculin was given to 70 children intranasally and was apparently tolerated very well. The method proved useless in extensive fibrosis and was considered inadvisable in patients with generalized lymphatic involvement, active pulmonary tuberculosis, and exacerbation of a tuberculous process anywhere in the body.

Kalkoff [98] became interested in the problem of tuberculosis of the cervical glands, which precedes the development of lupus vulgaris in 35 to 50% of the cases. In these patients he surmises the incidence of tuberculous primary foci in the nasopharyngeal mucosa of the tonsils, nose, gingiva, and middle ear. The possibility of hematogenous dissemination has also to be considered.

In 50 patients with cutaneous tuberculosis, 49 showed multiple calcifications of the lung. During both World Wars, a definite increase in cervical lymphadenopathy was observed in Germany, especially among the better-fed rural population, which points to the importance of ingestion tuberculosis as a pathogenetic factor for reinfection or superinfection. The author states that cervical lymphadenitis in adults is most probably caused by endogenous exacerbation within the glands.

Vaccarezza[99] reviews with critical evaluation the various methods in the treatment of tuberculous lymphadenopathy. The conservative methods include sanatorium rest with a high-vitamin diet. While it was customary to send children to the seashore and adults to the mountains, the climate does not seem to have any decisive influence on the course of the disease.

Tuberculin and vaccines are considered of no value, the benefit of gold and copper seems highly questionable, and the popularity of calcium is also more psychological than clinical. Heliotherapy and actinotherapy have a certain bacteriostatic effect, and x-ray irradiation has proved helpful in carefully selected cases.

Surgically, the author recommends repeated aspirations of cold abscesses, excision of isolated caseous glands without periadenitis, and electrocoagulation of fibrocaseous lesions.

According to the pathological forms, the therapeutic indications are as follows:

1. Benign lymphogranuloma: rest, cod liver oil, roentgen irradiation (success 80 to 100%)
2. Caseous purulent lymphoma: same regimen as above, aspiration of cold abscess, heliotherapy for fistula (success 40 to 60%)
3. Proliferative lymphogranuloma: x-ray treatments (success 40 to 50%)
4. Cirrhotic fibrotic lymphoma: no treatment
5. Caseous purulent lymphogranuloma: excision, curettage, heliotherapy
6. Calcified lymphadenitis: no treatment

This survey does not include the application of streptomycin and calciferol, which therefore gives it historical rather than practical importance.

Wissler [100] studied the effects of streptomycin on tuberculous lymphadenitis and confirmed the observation of American authors that the antibiotic is useless by topical application. Four cases of ulcerative scrofula were treated with intramuscular injections of streptomycin, which caused prompt healing within four weeks in three cases (75%). Most resistant to streptomycin are the large fibrotic solitary lymphomata, which also withstand direct injection of the drug into the glandular tissue.

CALCIFEROL TREATMENT

Since the end of World War II there has been a certain amount of interest in Europe in calciferol (crystalline vitamin D_2, $[C_{28}H_{43}OH]$, produced by irradiating ergosterol) as a reportedly successful adjuvant in the treatment of lupus and tuberculous adenitis.

Charpy [101] was the first to try out vitamin D_2 in lupus. In his original publication he outlined the therapeutic technique, consisting of a "period of attack" (15 mg. of calciferol once a week for three months), followed by a "period of consolidation" (15 mg. every two weeks for three months) and supplemented by "periods of maintenance" during spring and fall of the years following (15 mg. once a month in March, April, May and September, October, November). The drug therapy is supported with plenty of milk and moderate doses of calcium gluconate. Charpy's first survey comprised 27 cases, 8 of which healed on calciferol alone and 19 on calciferol combined with diathermy coagulation. All patients showed rapid and complete healing of their tuberculous skin lesions. The author reports similar good results in tuberculous orchiepididymitis, lymphadenitis, and indurated erythema and occasional benefits in pulmonary tuberculosis. Lupus erythematosus did not seem to be affected by calciferol.

In a follow-up study one year later, Charpy [102] gives a modified schedule for calciferol consisting of three doses of 15 mg. of vitamin D_2 during the first week, two during the second to the fourth week, and once a week for the following four months. This second paper describes five cases, all of which received calcium gluconate during their calciferol treatment. Three healed spontaneously within four weeks, and the remaining two required additional diathermy coagulation.

In England, Dowling and Thomas [103] were among the first to use calciferol in the treatment of lupus vulgaris. In their first study they outlined Charpy's method

and discussed the pharmacological effects of calciferol on the calcium level of the blood serum, and the toxic reactions of the drug. They came to the conclusion that the use of high doses of vitamin D_2 (Ostelin high potency tablets) presents a definite progress in the treatment of lupus vulgaris. Their first series comprised eight patients, the second series five, resulting in healing in 50% and improvement in 30%, while the remaining 20% did not respond. The toxic reactions included nausea, anorexia, depression, and mild and transitory renal damage. The authors were able to avoid these complications by keeping the daily dosage of calciferol under 150,000 units and to interrupt the treatment temporarily when serum calcium determinations showed a hypercalcemia.

The second publication [104] describes in some detail five cases of lupus, which received about 100,000 units of calciferol daily, effecting healing of the skin lesions, even in old neglected cases.

Wallace [105] chose five patients with tuberculous cervical adenitis, sinus formations, and cold abscesses, who received Ostelin high potency tablets twice a day for three to four months. The effects were most gratifying, resulting in shrinkage of tuberculous glands and closure of the sinus tracts. Four of the five cases showed definite clinical improvement. The fifth case, a patient with a cold abscess in the cervical region, needed excision and curettage after conservative treatment failed.

In 1947, Taillens [106] presented a paper at the annual session of the Otorhinolaryngological Society in Basel, Switzerland, reporting on 20 cases of upper respiratory tuberculosis treated with calciferol. The series included cases of the ulcerative type of the mouth and rhinopharynx, subacute miliary oropharyngeal tuberculosis, acute diffuse tuberculosis of the larynx with edema, multiple endonasal tuberculomata with oral lupus, and tuberculous abscess of the larynx with fistula formation. All these cases responded well to treatment, with the exception of a case of tuberculous otomastoiditis, which showed no improvement under vitamin D_2.

The author concluded that Charpy's treatment is beneficial not only in the forms of lupus mentioned in the original French publication but also in the various forms of tuberculosis of the nose, mouth, pharynx, tonsils, and larynx, either acute or chronic. He emphasizes that tuberculous lesions of the mucosa need a higher dose of vitamin D_2 than does lupus vulgaris. Even cases of long standing which were previously and unsuccessfully treated by the conventional means of therapy, i. e., cauterization and irradiation, reacted favorably to calciferol. Permanent cicatrization was obtained in cases of sinus and fistula formation.

Noguer More,[107] Chalmeton,[108] and Priest [109] published cases of lupus of the ear, nose, and gums healed with calciferol.

One of the more substantial surveys on the effect of calciferol in tuberculous adenitis was done by Suzette Gauvain,[110] who presented a series of 26 children and 9 adults, describing the therapeutic technique in some detail. Shortly after the institution of calciferol medication there is a transitory flare-up, with swelling or softening of the nodes, abscess formation, reddening of the sinuses, and increased drainage. This allergic response is followed by increased calcification and decreased periadenitis. Histological examinations of the glands show accelerated healing, with calcium deposits impregnated in the caseous material, fibrous encapsulation, and, sometimes, invasion of the glandular tissue by fibroblasts.

The daily dosage of calciferol amounted to 100,000 units in children, up to a total of 2,000,000 to 16,000,000, and 150,000 units daily in adults, up to 7,000,000 to 46,000,000, for the entire therapeutic trial. Toxic reactions consisted of anemia, constipation, general malaise, nausea, vomiting, and anorexia. Thirst and polyuria were frequently observed and readily counteracted by a generous intake of fluids. Some cases showed evidence of renal impairment, which was always reversible after the medication was interrupted. The routine laboratory work during the therapeutic survey determined the red blood cell count, hemoglobin content, white blood cell count, differential count for the white cells, E.S.R., blood urea, serum calcium, urinalysis, and the renal function tests when necessary.

Finally, there are three case histories which deserve short mention. Leroux and Hérard,[111] at a session of the Laryngological Society of the Hospitals of Paris, presented a 19-year-old girl with lupus of the nose and palate treated according to Charpy's method with vitamin D_2 and calcium, supplemented by diathermy coagulation of the endonasal lesion and ultraviolet irradiation of the palate.

Mayoux and Martin [112] saw a 31-year-old nun suffering with nasal obstruction, who showed extensive lupus involvement of both nostrils, the posterior wall of the pharynx, and the left posterior pillar, and who was successfully treated with calciferol.

Finally, there is an observation by Green,[113] who treated a case of lupus vulgaris of the left cheek and left ear lobe, first unsuccessfully with ammoniated mercury and then with calciferol, which caused a dramatic clearing of the cutaneous lesions. This case, incidentally, developed tuberculids during calciferol treatments on the cheek, forehead, chin, and nose, which subsided after ultraviolet irradiation.

TUBERCULOSIS OF THE NOSE AND SINUSES

The eight references on tuberculosis of the nose which we found in our survey are all contributions to medical casuistics; their value belongs to the field of clinical bibliography rather than to the progress in therapy. It is, however, reasonable to assume that during the past four-year period, which has not, as yet, been covered by our literary survey, the effects of streptomycin, PAS, and isoniazid on tuberculosis of the nose and sinuses have been covered in detail.

Basombrio and Capurro [114] treated a 53-year-old man, who presented several lenticular nodes on the tip and left wall of the nose, which were deep red, telangiectatic, and indolent. There was extensive endonasal nodular lupus involving the septum and the middle and upper turbinates. The chest film failed to give any evidence of active tuberculosis, and the sputum was negative. Tuberculin reaction was positive, and biopsy examination of the nasal lesions classified them as angiolupoid of the nose. The patient was treated with chaulmoogra oil and an iodine preparation, apparently with success.

Arzt [115] presented a case of nodular ulcerative lupus at a clinical session in Vienna. The patient showed involvement of the nose, right cheek, and chin, associated with swelling and deformity of the phalangeal, metacarpal, and metatarsal bones, which on x-ray examination proved to be multiple cyst formations.

Calafat [116] described two cases of tuberculosis of the nasal septum: The first was in a 20-year-old boy with pulmonary cavitary tuberculosis and a tuberculoma obstructing the right nostril, which was treated with electrocoagulation, and the second was in a 50-year-old woman with healed Pott's disease and residual pul-

monary tuberculosis, with an ulcerated perforation of the nasal septum, which proved to be tuberculous on histological examination. She was treated with ultraviolet radiation, tuberculin, and gold, with good results.

Videgain Salaverria [117] gives a literary survey of the tumoral formations of nasal tuberculosis, followed by a clinical discussion of the pathology, occurrence, age groups, symptoms and signs, differential diagnosis, prognosis, and treatment of nasal tuberculoma. The article is illustrated by the case history of a 38-year-old woman, who consulted the author because of respiratory obstruction in the right nostril. Examination showed a tumoral growth which bled readily on touch. A chest roentgenogram showed residual, and apparently quiescent, pulmonary tuberculosis. The Mantoux reaction was positive. A biopsy confirmed the tuberculous nature of the pedunculated growth. Resection was followed by good cicatrization.

Wille [118] presents the case of a 17-year-old boy, who was admitted with a two years' history of repeated epistaxis from the left nostril. Investigation failed to reveal any evidence of exposure to tuberculosis, and a chest film taken after admission did not reveal any pulmonary pathology. The nasopharyngeal examination showed a prominent plum-sized tumor with an uneven reddish surface hanging over the edges of the posterior nares and covering the rear part of the septum. Instrumental probing produced a slowly oozing hemorrhage from the left nostril. The tumor was resected and proved on histological examination to be a polyp with specific tubercle formation. Search for other tuberculous foci (x-rays of the hands and feet, bronchoscopy) was negative. In view of the tuberculous nature of the tumor, the patient underwent a prophylactic tonsillectomy, but the tonsils were found to be free of tubercles. The patient was well and symptom-free at the time of publication.

Schubert [119] saw a 30-year-old woman with bilateral pulmonary tuberculosis, who showed a draining sinus surrounded by granulation tissue between the second and the third molar on the upper right. X-ray studies showed a markedly obscured antrum, and biopsy of the granular tissue revealed its tuberculous nature. The case was treated surgically by operation on the antrum according to the Caldwell-Luc method.

Kanaguinis [120] was consulted by a woman who for 10 years had had dysphagia and dryness of the oronasal mucosa. She was suffering from endonasal lupus extending to the pharynx, soft palate, and tonsils, and was treated with streptomycin. The lesion showed prompt regression after the short period of one week of treatment.

Finally, there is the observation of Portela [121] of a case of granulomatous nasal lupus, which he treated with curettage of the granulation tissue under local anesthesia, dusting the wound surface with potassium permanganate, and covering it with a sterile petrolatum (Vaseline) gauze dressing. There was healing within three weeks.

LARYNGEAL TUBERCULOSIS

We have already reported on the therapeutic progress in laryngeal tuberculosis under various headings of antibiotics and chemotherapeutics, but there are still a number of papers left wherein the syndrome is discussed under different aspects, which we found difficult to catalogue in the previous chapters, and which we therefore enumerate in more or less chronological order.

Bernard and Delarue [122] report the case of a 52-year-old working woman complaining of burning sensation in her throat. On laryngoscopy she showed numerous

small nodules and edema of the larynx, which were shortly thereafter followed by ulceration and necrosis. Biopsy revealed acute miliary tuberculosis. The patient was treated symptomatically by injection of the superior laryngeal nerve with procaine hydrochloride (Novocain) and alcohol to relieve the dysphagia. Interestingly, the chest films were negative on first examination, but three months later they revealed extensive miliary dissemination. Death occurred within five months after the patient's admission, and autopsy findings confirmed the authors' diagnosis of primary laryngeal tuberculosis with secondary pulmonary dissemination.

Meda [123] became interested in the coexistence of tuberculosis and syphilis, and after a general discussion on the combination of the two specific infections, he presents his case material on 186 patients in all, 151 males and 35 females, who were hospitalized for pulmonary tuberculosis and showed a positive Wassermann reaction. Eighty-six (46%) of these patients had evidence of tuberculous laryngitis showing the following pathological forms:

Diffuse or localized inflammation	28
Ulcerative-infiltrative lesions	56
Scarred gumma	1
Left laryngeal hemiplegia	1

The coexistence of syphilis does not seem to have any bearing on the incidence of the morphological aspects and clinical progress of the laryngeal tuberculosis unless there is a slightly increased tendency in the syphilitic toward chronic fibrosis and therefore to a more benign course. Syphilis does not change the therapeutic problem of the laryngeal lesions, making allowance for the conventional syphilis treatment.

Ramond [124] presents the case of a 64-year-old man, who complained of hoarseness, loss of weight, and dysphagia. The laryngoscopic examination showed diffuse infiltration and hypertrophy of the interarytenoid region, the epiglottis, aryepiglottic folds, and the ventricular bands. The chest film showed some apical scars, generalized emphysema. Biopsy and sputum examination revealed the tuberculous nature of the laryngeal disease. Some remarks on differentiation between tuberculosis and cancer of the larynx are included. The case is described in great detail but offers little beyond its mere casuistic contribution.

Riba and Pacios [125] describe the technique of injection into the superior laryngeal nerve with 85% alcohol and 2% procaine hydrochloride for the relief of dysphagia, comparing the various methods described by Frey and Valentin, Boncour, van den Hutten, and Wessely. There is one case history.

According to Jaros,[126] the structure of the lymphatics of the larynx is the key for the understanding of tuberculosis involvement. In addition to the lymphatic route, the author discusses the canalicular and hematogenous invasion and the pathology of edema in tuberculous laryngitis, which can be collateral, perifocal, or chronic as an expression of tuberculous lymphangitis. Tuberculoma and lupus of the larynx are described in detail, and the importance of paresthesia and hoarseness as early symptoms is stressed.

Eschweiler [127] published a scholarly treatise on the functional pathology of laryngeal tuberculosis, describing the involvement of all the various structural components of the larynx, its muscles and cartilages, and commenting upon the morphological foundation of specific symptoms, such as pain, hoarseness, dysphagia,

and dyspnea. Twenty-four cases, with the histology of their laryngeal lesions, are described in great detail, with particular reference to the correlation between involvement of laryngeal muscles and functional disturbances. This is an interesting and original work, written for the anatomist and pathologist rather than the practitioner.

D'Angelo [128] surveys the pathology and frequency of bovine infection in children and adults and describes seven cases of tuberculous laryngitis of bovine origin. The extensive bibliography attached to this paper comprises more than 250 references, which makes it valuable for anyone interested in the literature or research on this particular subject.

Vetter [129] discusses the publications of Schlitter, Wisler, and Ellonen in addition to the study of Gsell and Uehlinger of 1936, analyzing the infant material of the Luebeck disaster as far as the problem of primary upper respiratory tuberculosis was concerned. Four cases of upper respiratory tuberculosis are briefly sketched; otherwise this paper offers little of interest.

Piéchaud's [130] communication consists of some general observations on tuberculous laryngitis, which he finds to be almost always secondary to systemic disease and rarely encountered in children, even with a highly positive sputum of comparatively long standing. The bulk of the cases of laryngeal spreads occur between the ages of 20 to 40; they are far less frequent in the aged. Among the contributing causes are pregnancy, laryngeal stress (town criers, street vendors, singers, etc.), exposure to dust, recurrent nose and throat infections, chronic otitis, ozena, and, supposedly, the use of alcohol and tobacco. Before the introduction of modern drug therapy, laryngeal complications occurred in about every third patient with pulmonary tuberculosis. There is an important synergy between the lungs and larynx through their common vegetative innervation.

Tavani [131] agrees with Piéchaud on the rare occurrence of laryngeal tuberculosis in early childhood but states that the syndrome occurs more frequently during puberty because of the increased incidence of pulmonary tuberculosis. In this age group, the spread occurs probably through hematogenous and lymphogenous routes, while later, in adult years, the sputogenous infections become more frequent. Thirteen cases of laryngeal tuberculosis in young people comprise the core of the study.

Johnston [132] gives a short clinical description of laryngeal tuberculosis designed for the medical student or general practitioner rather than the specialist.

Doll [133] is interested in the effects of quartz-light therapy in laryngeal tuberculosis. Among 80 patients he treated with cold quartz light for a period of five and one-half years, there were 39 cases of laryngeal tuberculosis; of these, 10 were cured, 6 considerably improved, and 7 improved, while the remaining 16 either did not change or deteriorated. Ten of the cases are described in detail. The review of the literature is based mostly on therapeutic results in German and Austrian hospitals.

Champeaux and Adrian [134] describe the appearance of mediastinal and subcutaneous emphysema and paralysis of the left recurrent nerve in a patient treated with pneumothorax for a left-sided pulmonary lesion. The paralysis of the left vocal cord outlasted the regression of the emphysema for many months.

Meda [135] reports his experiences with a compound of the sulfone group (diaminodiphenylsulfone didextrose sodium sulfonate) in 50 cases of laryngeal tuberculosis.

A 60% solution of the drug was used for endolaryngeal application. It showed a fairly satisfactory analgesic effect, lasting three to four hours, but its curative value was questionable, with the exception of a few cases with early infiltration.

Klebanova and Filatova [136] performed histological examinations on laryngeal nerves in patients with tuberculous laryngitis, and claim to have found degenerative changes caused by the invasion of tubercle bacilli into the nerve tissue. They explain the dysphagia on the basis of this bacillary penetration rather than on toxic neuritis. They were unable to demonstrate tubercle bacilli in the glossopharyngeal and vagus nerves but found them in the superior laryngeal nerves in 3 out of 50 cases and in 1 out of 7 phrenic cases.

De Silveira [137] publishes a short preliminary notification, describing the results of injections of natural vitamin K in the treatment of dysphagia in laryngeal tuberculosis. In his nine cases under observation at the time of this report, the pain subsided remarkably, making deglutition possible and improving the nutritional state of the patients.

Guillon [138] used aerosol penicillin in three patients with dysphagia in laryngeal tuberculosis, which alleviated the pain and showed a cleansing effect on secondary organisms superimposed on tuberculous ulcers. Naturally, the tuberculous lesions per se were not influenced by penicillin.

Moruzzi and Borsella [139] add one more discussion on the various pathways of tuberculous invasion of the larynx, evidently a theme dear to the heart of European authors. Hematogenous origin of tuberculous laryngitis may be surmised in miliary tuberculosis even with negative sputum, in the mixed miliary and nodular form with either negative or positive sputum, and, finally, in the clinically fulminating forms with a sudden onset and a rapidly doomed course.

Among 1,084 patients, they found 81 cases (4.49%) with laryngeal tuberculosis, which showed the following pathological forms:

Simple catarrhal congestions	8
Infiltrations and edemas	31
Ulcerations	33
Hypertrophic lesions	7
Mixed forms	2

From the Department of Anesthesia at Bellevue Hospital comes a study by Papper and Rovenstine [140] on procaine block of the superior laryngeal nerve as a palliative procedure to lessen the pain of dysphagia in extensive ulceration of laryngeal tuberculosis. The topography and technique of the injection are described in detail, using 2 cc. of 2% procaine solution followed by 2 cc. of absolute alcohol 10 minutes later. Fifteen patients with extensive pulmonary involvement were treated, and all experienced an immediate and considerable relief, lasting from several weeks to months. A single injection was sufficient in all cases but two, who had to be blocked twice. All patients died within one year after the onset of the laryngeal involvement. The symptomatic results were considered excellent in 10, fair in 3, and poor in two cases.

Another 15 cases with pharyngolaryngeal tuberculosis were treated by Benda and Ludmer [141] with topical applications of 1 : 1,000 solution of epinephrine (Adrenalin). The lesions were swabbed for two weeks several times daily, with relief of dysphagia, healing of ulcer, and regression of edema in 14 out of 15 cases.

Rosenthal [142] gives the case history of a 38-year-old man with far-advanced pulmonary tuberculosis complicated by tuberculous ulceration of the pharynx, palate, tonsils, pillars, soft tissue of the nose and adjacent facial areas, upper lip, and cervical and submaxillary lymph nodes. The larynx could not be visualized. Death occurred three weeks after the patient's admission. The autopsy corroborated the extensive clinical findings and showed in addition tuberculous involvement of the epiglottis.

Gibelli [143] treated 100 cases of laryngeal tuberculosis by surgical interruption of the recurrent nerve, 14 by injection of 85% alcohol, and 86 by neurotripsy. The crushing of the nerve is indicated in cases with unilateral infiltration of one cord or arytenoid with or without superficial ulceration and is followed by hoarseness and paralysis of the cord, which lasts anywhere from three to five months. The therapeutic results showed recovery in 47 patients, improvement in 14, no change in 9, and deterioration in 30.

Mecz and Puyo [144] report a rather unusual incident in a patient with laryngopulmonary tuberculosis and therapeutic pneumothorax, who developed a sudden occlusive edema of the larynx after inhalation of some aromatic herbs and was saved from suffocation by an emergency tracheotomy. It is interesting to note that after an artificial airway was established, the tuberculous lesions of the larynx showed considerable clearing.

Black [145] conducted a survey on 60 patients with laryngeal tuberculosis hospitalized for minimal, moderate, and far-advanced pulmonary tuberculosis, to study the comparative value of glucosulfone sodium, penicillin, and ultraviolet irradiation with and without cauterization. Group I comprised 20 patients receiving glucosulfone sodium by daily vaporization: Four were healed, 6 improved, 3 unchanged, and 7 worse. Group II involved 10 patients getting topical applications of penicillin solution with a De Vilbis spray six times daily: Three were healed, 1 improved, 1 unchanged, and 5 worse. The remaining 30 patients, in Group III, were treated by ultraviolet irradiation and cautery: Two were healed, 6 improved, 4 unchanged, and 18 worse. The author concludes that glucosulfone sodium and penicillin are beneficial as cleansing agents but otherwise are of little help in the severer forms of laryngeal involvement and should only be considered if streptomycin is either not available or contraindicated.

Bourgeois and Dupont [146] tried tyrothricin insufflation in seven patients with laryngeal tuberculosis suffering of dysphagia. The patients were given 0.5 to 1 mg. of tyrothricin per cubic centimeter of isotonic glucose solution in four daily applications. No adverse local or general reactions were observed. All patients showed good tolerance, complaining only of the unpleasant taste of the drug. Pain and dysphagia improved in all patients. The edema and ulcerations regressed in some of them, while granulation tissue was not appreciably affected. The authors compare the functional and structural improvement after tyrothricin with that after streptomycin, which is more expensive and not as well tolerated in many instances. They believe that the combination of the two drugs is worth a therapeutic trial.

Vallesi [147] examined a 33-year-old housewife suffering from dysphagia, hoarseness, and dyspnea. Laryngoscopy revealed a tumor attached to the epiglottis and thickening of the left vocal cord, which, however, showed normal function. Biopsy classified the tumor as a fibroid tuberculoma, which was resected. The chest film was normal; there was no evidence of any preceding systemic tuberculosis.

Fouquet, Bourgeois, and Dupont [148] attended a clinical meeting of the Society of the Hospitals of Paris, at which Fouquet reported on 50 cases of laryngeal tuberculosis treated with streptomycin, which showed rapid functional and structural improvement within two to three weeks. Bourgeois and Dupont tried tyrothricin in seven cases of laryngeal tuberculosis, with good symptomatic relief in all cases; while edema and ulceration were reduced in less than half of the cases, granulation and infiltration did not show any appreciable change.

Watkin [149] emphasizes that tracheotomy undertaken for laryngeal tuberculosis does not necessarily show an immediately hopeless prognosis, as the study of the older literature would imply. While the ultimate outlook in such cases is usually poor, tracheotomy has its definite place as a life-saving and life-prolonging procedure, depending on the type of involvement of the underlying pulmonary tuberculosis.

The gist of the paper is a case report of a 38-year-old woman with a history of long-standing cough occurring especially at night. In January, 1944, while working, she experienced a sudden dyspnea, for which she had to be admitted to a hospital. Examination revealed considerable laryngeal edema, which necessitated an emergency tracheotomy. During the following weeks the edema subsided, and the vocal cords could be visualized covered by granulation tissue, which on biopsy was found to be tuberculous. Five sputum specimens and gastric lavages were negative for tubercle bacilli. A chest film showed bilateral apical productive infiltration but no cavity formation on either side. Five weeks after her admission, the tracheotomy tube was removed, and the granulation tissue of the incision was treated with roentgen radiation, resulting in good healing of the wound. After one year the larynx looked clean, making allowance for a slight thickening of the vocal cords, and the patient was allowed to return to work in January, 1945. In November of the same year she suffered a reactivation of her old pulmonary and laryngeal tuberculosis, and after an unsuccessful attempt to establish a collapse by pneumothorax on either side, the patient died in October, 1947. There was no autopsy.

TUBERCULOSIS OF THE EARS AND MASTOIDS

Tuberculous involvement of the ears and mastoids has become infrequent since the advent of chemotherapeutics and antibiotics after World War II, and, consequently, the publications on the subject are becoming more and more scanty. The articles we found are mostly limited to the communication of case histories and contribute little of interest.

Bordone [150] operated on five patients with tuberculous otomastoiditis and treated them with tuberculin during the postoperative period, with very satisfactory results.

Kizoulis,[151] emphasizing the rarity of primary tuberculosis of the middle ear, presents a case in which a 10-week-old baby was admitted to the Municipal Hospital at Athens with a purulent discharge from the right ear, swelling of the right retromaxillary glands, and right facial paresis. During the following two weeks the otorrhea failed to respond to the conventional means of treatment, fever and anorexia persisted, and the baby did not gain weight. On admission the Pirquet reaction was negative, but two weeks later the infant showed a positive Mantoux reaction in the presence of a normal chest film and a negative gastric lavage; how-

ever, the auricular pus inoculated into a guinea pig proved to be tuberculous. The patient, not quite 2 years old, died of pneumococcic meningitis. The autopsy showed extensive osteitis of the right middle ear, with considerable necrosis and caseous degeneration of the retromaxillary glands, while the lungs still failed to show any tuberculosis, proving the primary nature of the tuberculous process in the middle ear.

Another case was presented by Magnard,[152] who observed a 6-year-old child who developed a marked retroauricular swelling while she was being treated for pulmonary tuberculosis in a sanatorium. A preoperative diagnosis of mastoid abscess was made, and the patient was operated on, revealing abundant suppuration and extensive necrosis of the mastoid cells, with formation of granulation tissue. The examination of osseous scrapings revealed tuberculous mastoiditis. The incision showed good cicatrization, with formation of a small draining sinus.

Fisher and Malkin [153] performed a mastoidectomy on an 8-week-old girl with otorrhea and right facial paresis, and during the postoperative period gave her streptomycin (a total of 26.5 gm. during 13 weeks). The histological examination of the antral granulation tissue and culture of the pus demonstrated tubercle bacilli.

Finally, we have a conventional study of Mayoux [154] on tuberculosis of the ear, describing the etiology, pathological forms, and treatment of the disease. The paper was published while the results of streptomycin treatment were still under study, and it therefore was already dated at the time of its appearance.

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Special Reports

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE AND REHABILITATION OF THE AMERICAN MEDICAL ASSOCIATION

AS OF NOV. 1, 1954

Acousticon Models A-17, A-180, A-185, & A-1520
Mfr., Dictograph Products Inc.
95-25 149th St.
Jamaica 35, N. Y.

Audiotone Models 11 & 15
Mfr., Audio Company of America
5305 N. 6th St.
Phoenix, Ariz.

Audivox Models Super 67 & 70
Mfr., Audivox, Inc.
123 Worcester St.
Boston 18

Aurex Models L & M
Mfr., Aurex Corporation
1117 N. Franklin St.
Chicago 10

Beltone Mono-Pac Model "Lyric"

Beltone Mono-Pac Model M

Beltone Mono-Pac Model "Rhapsody"
Mfr., Beltone Hearing Aid Co.
2900 W. 36th St.
Chicago 32

Cleartone Model 700
Mfr., American Sound Products, Inc.
1303 S. Michigan Ave.
Chicago 5

Dahlberg Junior Model D-2

Dahlberg Model D-3 (Tru-Sonic)

Dahlberg Model D-4 (Tru-Sonic)
Mfr., The Dahlberg Company
Golden Valley
Minneapolis 22

Fortiphone Models 19LR, 20A, 21C, & 22
Mfr., Fortiphone Limited
Fortiphone House
247 Regent St.
London, W.1, England

Distr., Anton Heilman
75 Madison Ave.
New York 17

Gem Model V-60
Mfr., The Gem Ear Phone Co., Inc.
50 W. 29th St.
New York 1

Goldentone Models 25, 69, & 97
Mfr., Johnston Hearing Aid Mfg. Co.
708 W. 40th St.
Minneapolis 8

Distr., Goldentone Corp.
708 W. 40th St.
Minneapolis 8

Maico Maxitone

Maico Top Secret Model L
Mfr., The Maico Company, Inc.
21 N. 3rd St.
Minneapolis 1

Micronic Model Mercury
Mfr., Audivox, Inc.—Successor to Western Electric Hearing Aid Division
123 Worcester St.
Boston 18

Microtone Models T-10 & T-612
Mfr., The Microtone Corporation
758 S. Mississippi River Blvd.
St. Paul 1

Normatone Model C

Normatone Model D-53
Mfr., Johnston Hearing Aid Mfg. Co.
708 W. 40th St.
Minneapolis 8

Distr., Normatone Hearing Aid Co.
22 E. 7th St.
St. Paul 1

Otarion Models B-15 & B-30

Otarion Models F-1 & F-3

Otarion Model H-1, Custom "5"
Mfr., Otarion, Inc.
185-7 Ashford Ave.
Dobbs Ferry, N. Y.

Paravox Model D (Top-Twin-Tone)

Paravox Model J (Tiny-Myte)
Mfr., Paravox, Inc.
2056 E. 4th St.
Cleveland 15

Radioear Model 62 Starlet

Radioear Model 72

Radioear Model 82 (Zephyr)
Mfr., E. A. Myers & Sons, Inc.
306 Beverly Rd.
Mt. Lebanon
Pittsburgh 16

Distr., Radioear Corporation
306 Beverly Rd., Mt. Lebanon
Pittsburgh 16

Silvertone Models H-16, J-92, & P-15
Mfr., Johnston Hearing Aid Mfg. Company
708 W. 40th St.
Minneapolis 8

Distr., Sears, Roebuck & Co.
925 S. Homan Ave.
Chicago 7

Solo-Pak Model 99
Mfr., Solo-Pak Electronics Corp.
Linden St.
Reading, Mass.

Sonotone Models 910, 920, 925, 940, 966, 977, & 988
Mfr., Sonotone Corporation
Elmsford, N. Y.

Televox Model E
Mfr., Televox Mfg. Company
1307 Sansom St.
Philadelphia 7

Telex Models 99, 200, 400, 500, 952, 953, & 1700
Mfr., Telex, Inc.
Telex Park
St. Paul 1

Tonamic Model 50
Mfr., Tonamic, Inc.
12 Russell St.
Everett 49, Mass.

Tonemaster Cameo Model
Mfr., Tonemaster Mfg. Co
128 S. Monroe St.
Peoria, Ill.

Unex Models 200 & 230
Mfr., Nichols & Clark, Inc.
Hathorne, Mass.

Zenith Miniature 75

Zenith Model Royal

Zenith Model Super-Royal

Zenith "Regent"
Mfr., Zenith Radio Corporation
5801 W. Dickens Ave.
Chicago 39

(All aforementioned hearing aids have vacuum tubes.)

Accepted hearing aids more than five years old have been omitted from this list for brevity.

Transistor Hearing Aids Accepted

Acousticon Model A-300	1 transistor and 2 tubes
Acousticon Model A-310	1 transistor and 2 tubes
Acousticon Model A-330	3 transistors
Acousticon Model A-335 Mfr., Dictograph Products Inc. 95-25 149th St. Jamaica 35, N. Y.	3 transistors
Audivox Model 71 Mfr., Audivox, Inc. 123 Worcester St. Boston 18	3 transistors
Beltone "Concerto" Model Mfr., Beltone Hearing Aid Co. 2900 W. 36th St. Chicago 32	3 transistors
Maico Transist-Ear Model O Mfr., The Maico Company, Inc. 21 N. 3rd St. Minneapolis 1	3 transistors
Micronic "All American" Hearing Aid Mfr., Audivox, Inc.—Successor to Western Electric Hearing Aid Division 123 Worcester St. Boston 18	3 transistors
Microtone Model T1 (Red Dot)	3 transistors
Microtone Model T1 (Yellow Dot)	3 transistors
Microtone Model T31 (Micro-Mite)	1 transistor and 2 tubes
Microtone Model "Skylark" Mfr., The Microtone Corporation 758 S. Mississippi River Blvd. St. Paul 1	3 transistors
Otarion Model C-15	1 transistor and 2 tubes
Otarion Model D-1	3 transistors
Otarion Model F-22 Mfr., Otarion, Inc. 185-7 Ashford Ave. Dobbs Ferry, N. Y.	1 transistor and 2 tubes
Paravox Model KM (TRANSonic) Mfr., Paravox, Inc. 2056 E. 4th St. Cleveland 15	3 transistors

Radioear Model 820 — 3 transistors
Mfr., E. A. Myers & Sons, Inc.
306 Beverly Rd.
Mt. Lebanon
Pittsburgh 16

Distr., Radioear Corporation
306 Beverly Rd.
Mt. Lebanon
Pittsburgh 16

Sonotone Model 1010 — 1 transistor and 2 tubes

Sonotone Model 1111 — 3 transistors
Mfr., Sonotone Corporation
Elmsford, N. Y.

Telex Model 954 — 1 transistor and 2 tubes

Telex Model 956 — 3 transistors
Mfr., Telex, Inc.
Telex Park
St. Paul 1

Unex Model TR-3D — 3 transistors
Mfr., Nichols & Clark, Inc.
Hathorne, Mass.

Zenith Model Royal-T — 3 transistors

Zenith Model Super Royal-T — 3 transistors
Mfr., Zenith Radio Corporation
5801 W. Dickens Ave.
Chicago 39

Semiportable Hearing Aids Accepted

Ambco Hearing Amplifier (Table Model)
Mfr., A. M. Brooks Co.
1222 W. Washington Blvd.
Los Angeles 7

Aurex Hearing Aids (three types)
Mfr., Aurex Corporation
1117 N. Franklin St.
Chicago 10

Precision Table Hearing Aid
Mfr., Precision Hearing Aids
5157 W. Grand Ave.
Chicago 39

Sonotone Model 50 Professional Table Set
Mfr., Sonotone Corporation
Elmsford, N. Y.

Books

Dizziness: An Evaluation and Classification. By David Downs DeWeese, M.D. Price, $2.75. Pp. 80, with 2 illustrations. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1953.

This concise monograph is one in the publisher's series of "American Lectures in Internal Medicine" and, as such, continues to maintain the high level of scholarship set by the preceding publications. The subject is discussed not only from the limited aspect of the ear but from the broader aspect of the entire body as well, with dizziness being classified into two groups: non-systematized and systematized. The former is regarded in its application to the eyes, the proprioceptive system, and the central nervous system. The latter is taken up in the following order: the end-organ, eighth nerve, the nuclei, and brain stem. The differential diagnosis having been made easier by close attention to history and clinical details, a basis is established for rational therapy. For a quick review of the subject of dizziness, this book is suitable.

Directory of Organizations and Individuals Active in the Fields of Deafness and Otological Research. By Douglas Macfarlan, M.D. Price, $0.60. Pp. 88. Hearing Center, Hospital of the University of Pennsylvania, 36th & Spruce Sts., Philadelphia 4, 1954.

This directory was compiled to fill the need of a readily available pamphlet which would list who, what, where, and when in the fields of deafness and otological research. A directory of this type must be kept up to date, and the compiler must elicit the aid of all. He is to be commended for his initial efforts, which involved listings from many different sources. Naturally, corrections and additions are necessary; for example, a listing of approved audiometers should be included. All in all, this little book is exactly what its title represents, and for that reason it is a worthwhile contribution and should be available to those who may have need of the information it contains.

Ear, Nose, and Throat Diseases for Medical Students. By William McKenzie, M.B., B.Chir. (Cantab.), F.R.C.S. (Eng.). Price, $5.50. Pp. 260, with 95 illustrations. Williams & Wilkins Company, Mount Royal and Guilford Aves., Baltimore 2, 1953.

This simple little book by an English author presents those chief clinical findings which can be ascertained by the medical student, intern, or general practitioner using a flashlight, tongue depressor, otoscope, and tuning fork. It lends itself for review by the student, with questions at the end of each chapter, which by their nature seek to answer many practical problems. The author writes from his own experience, which, naturally, colors some of the presentation. Nevertheless, this at all times is interesting. Since the book was written for the medical student, the subject matter is not exhaustively treated; and with the limitations then defined, this book is recommended.

Directory of Otolaryngologic Societies *

FOREIGN AND INTERNATIONAL

Canadian Otolaryngological Society
(Société Canadienne d'Otolaryngologie)

President: Dr. G. Edward Tremble, 1390 Sherbrooke St. West, Montreal, P. Q.
Secretary: Dr. G. Arnold Henry, 170 St. George St., Toronto.
Place: Bigwin Inn, Lake of Bays, Muskoka, Ont. Time: June 16-18, 1955.

International Bronchoesophagological Society

President: Dr. André Soulas, 184 Avenue Victor Hugo, Paris 16.
Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.

International Congress of Audiology

Place: Leyden, Netherlands.
General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Holland.

International Course in Paedo-Audiology

Place: Groningen, Netherlands.
General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Holland.

Pan-American Association of Oto-Rhino-Laryngology and Broncho-Esophagology

President: Dr. Juan Manuel Tato, Azcuenaga 235, Buenos Aires, Argentina.
Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.
Meeting: Fifth Pan-American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology.
Place: San Juan, Puerto Rico. Time: February, 1956.
President of Congress: Dr. Juan H. Font, Medical Arts Building, San Juan.

Sixth International Congress of Otolaryngology

President: Dr. Arthur W. Proetz, 3720 Washington Blvd., St. Louis.
General Secretary: Dr. Paul H. Holinger, 700 N. Michigan Ave., Chicago 11.
Place: Hotel Statler, Washington, D. C. Time: May 5-10, 1957.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Francis W. Davison, Geisinger, Memorial Hospital, Danville, Pa.
Secretary: Dr. Hugh A. R. Kuhn, 112 Rimbach St., Hammond, Ind.
Place: Atlantic City, N. J. Time: June 6-10, 1955.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Walter H. Theobald, 307 N. Michigan Blvd., Chicago 1.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100-1st Ave. Bldg., Rochester, Minn.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

American Board of Otolaryngology

President: Dr. Frederick T. Hill, Professional Building, Waterville, Maine.
Secretary-Treasurer: Dr. Dean M. Lierle, University Hospitals, Iowa City.
Examinations: Hotel Marshall, Richmond, Va., March 6-10, 1955; Palmer House, Chicago, October, 1955.

American Broncho-Esophagological Association

President: Dr. Clyde A. Heatly, 11 N. Goodman St., Rochester, N. Y.
Secretary: Dr. F. Johnson Putney, 1719 Rittenhouse Sq., Philadelphia 3.
Place: Hollywood Beach Hotel, Hollywood, Fla. Time: March 15-16, 1955 (afternoons only).

American Laryngological Association

President: Dr. Henry B. Orton, 224 Delavan Ave., Newark 4, N. J.
Secretary: Dr. Harry P. Schenck, 326 S. 19th St., Philadelphia 3.
Place: Hollywood Beach Hotel, Hollywood, Fla. Time: March 13-14, 1955.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Kenneth M. Day, 121 University Place, Pittsburgh.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Place: Hollywood Beach Hotel, Hollywood, Fla. Time: March 15-16, 1955 (mornings only).

SECTIONS:

Eastern.—Chairman: Dr. Benjamin H. Shuster, 1824 Pine St., Philadelphia 3.
Place: Hotel Warwick, Philadelphia. Time: Jan. 7, 1955.

Southern.—Chairman: Dr. G. Slaughter Fitz-Hugh, 104 E. Market St., Charlottesville, Va.
Place: Medical School Auditorium, Charlottesville, Va. Time: Jan. 22, 1955.

Middle.—Chairman: Dr. James E. Croushore, 3001 W. Grand Blvd., Detroit.
Place: Sheraton-Cadillac Hotel, Detroit. Time: Jan. 24, 1955.

Western.—Chairman: Dr. Victor Goodhill, 2007 Wilshire Blvd., Los Angeles.
Place: The Town House, Los Angeles. Time: Jan. 15-16, 1955.

American Otological Society, Inc.

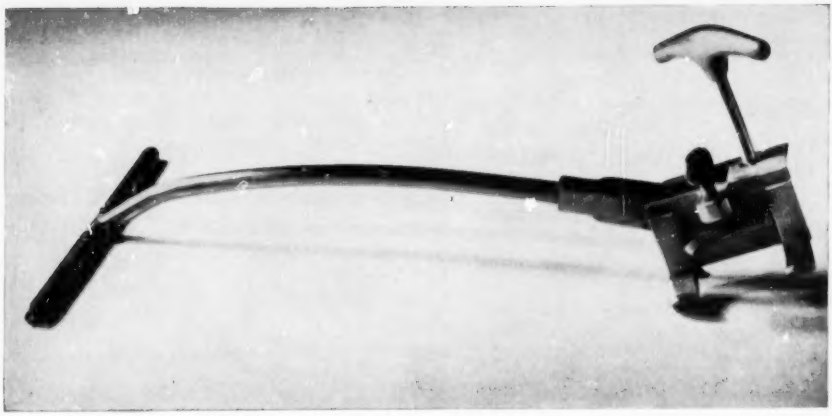
President: Dr. D. E. Staunton Wishart, 170 St. George St., Toronto 5, Canada.
Secretary-Treasurer: Dr. John R. Lindsay, 950 E. 59th St., Chicago 37.
Place: Hollywood Beach Hotel, Hollywood, Fla. Time: March 17 (afternoon), 18 (forenoon and afternoon), and 19 (forenoon), 1955.

American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery, Inc.

President: Dr. Matthew S. Ersner, 1915 Spruce St., Philadelphia 3.
Secretary: Dr. Louis Joel Feit, 66 Park Ave., New York 16.

American Society of Ophthalmologic and Otolaryngologic Allergy

President: Dr. F. Lambert McGannon, 14595 Madison Ave., Lakewood, Ohio.
Secretary-Treasurer: Dr. Michael H. Barone, 468 Delaware Ave., Buffalo 2.
Place: Palmer House, Chicago. Time: 1955.



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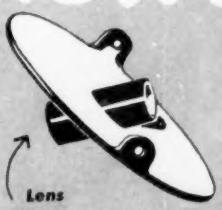

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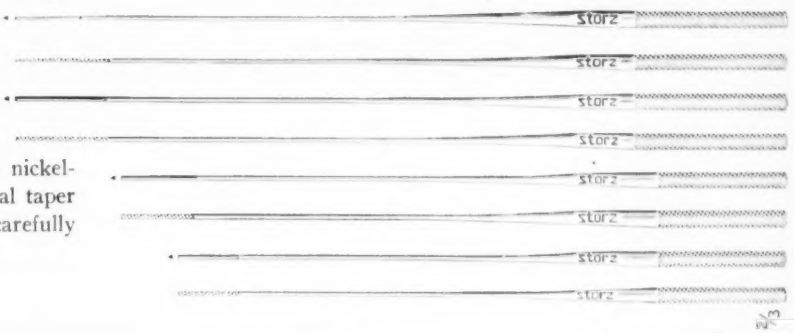

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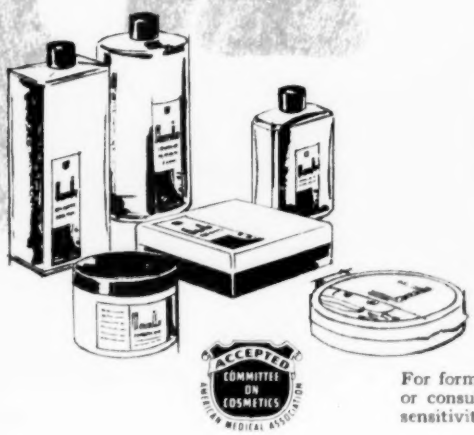

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